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## THE CAISSON FOR THE EAST PIER OF THE ST. LOUIS BRIDGE.

This celebrated structure, remarkable for the great depth to which it has been sunk, was completed Sept. 1, 1869, launched Oct. 18, 1869, was towed to its place, and had the first stone laid upon it, on the 25th Oct., 1869, and was finally sunk to bed rock, 128 feet below high water mark, on the 28th of February, 1870.

The caisson for the east abutment pier, the successful sinking of which, to a depth of 136 feet below high water mark, was announced in our last issue, has some points of difference, which will be pointed out below.

The construction of the caisson for the east pier is shown in the engraving, the letters referring to different parts as follows: A, air locks; B, air chamber; C, timber girder; D, discharge of sand pump; E, sand pumps; F, main entrance shaft; G, side shaft; H, iron envelope; I, bracing for the shell.

The workmen, descending the main shaft, entered the air lock, which then being closed from above, so as to prevent the escape of air from the interior of the caisson, was opened at the side for their admission to the air chamber.

The caisson is shown with the superstructure of masonry upon it, and sunk about three fourths of the way down to bed rock. The excavations of sand were ejected through the sand pumps, a mixed column of air, water, and sand being continually kept ascending from wells maintained at the bottoms of the pumps.

For particulars of the difficulties encountered; the reader is referred to pages 151, 376, 391, Vol. XIII., of this journal.

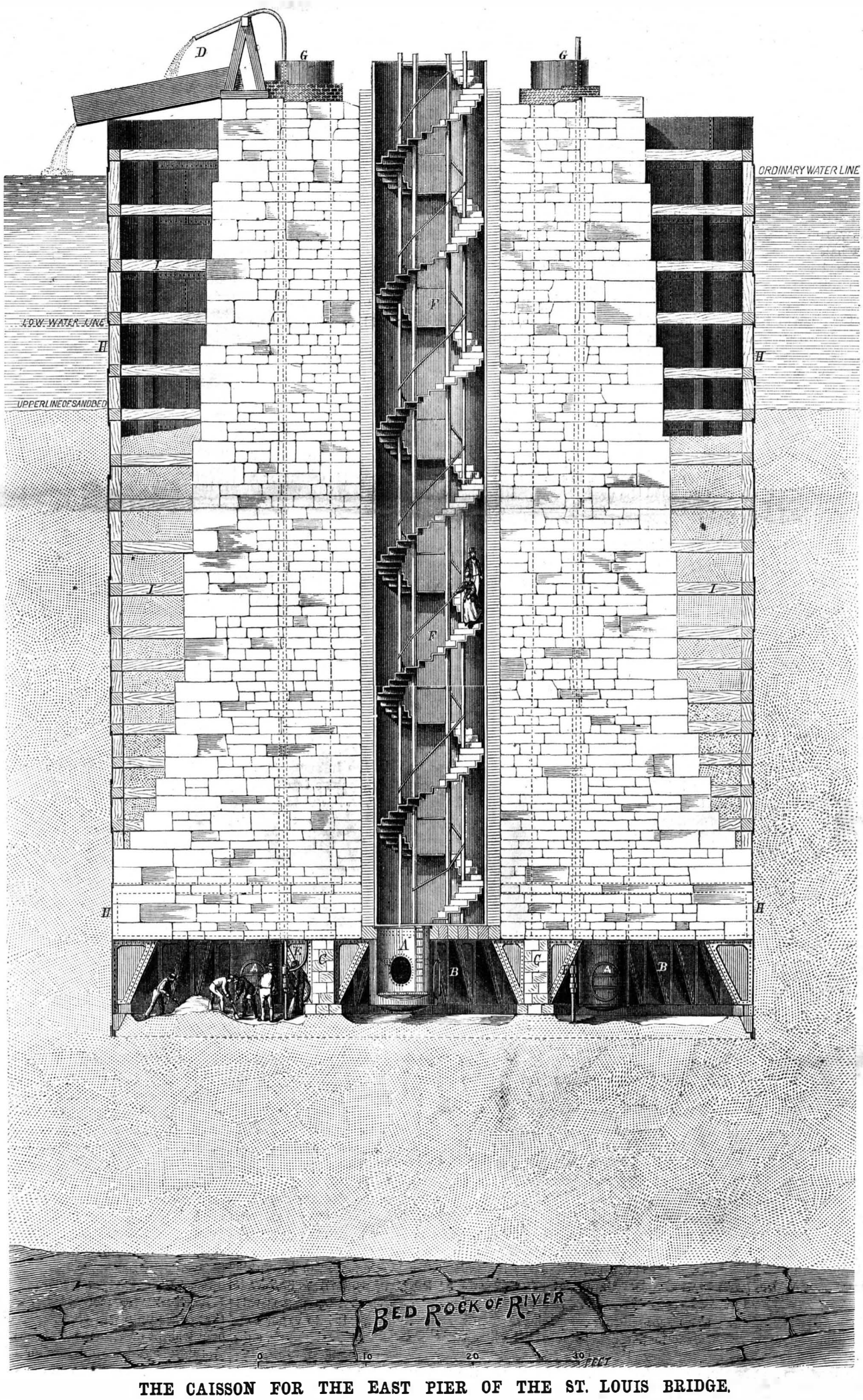
The width of cross section, shown in the engraving, is fifty feet, and the depth to which the caisson is sunk, as shown, is about sixty feet below the ordinary water line.

The east abutment caisson, as we have said, has some features differing from that of the east pier. The main shaft has two air locks at the bottom, instead of one, and their diameters are 8 ft., instead of 6 ft. as in that of the east pier. The east pier caisson had six other shafts of 4 ft. 9 in. in diameter, with air locks of the same diameter at the bottom of each. The east abutment caisson has only two other shafts, 4 ft. in diameter, with air locks 8 ft. in diameter. The shafts, other than the center shafts, were intended for use in case any embarrassment to free exit and entrance should occur, from accidental causes, in the main shafts. To avoid the labor of ascent over so long a stairway, the east abutment caisson was provided with an elevator, or lift, to raise the men to the surface.

These simple changes were found to add greatly to the health, comfort, and convenience of the men employed upon the work.

Changes in lighting this caisson were also adopted, considerable discomfort having been experienced through the generation of carbonic acid from the lamps used in the previous caisson. The calcium light was not used, on account of its great cost. A system of lighting by candles, inclosed in glass globes of strength sufficient to withstand the pressure, was adopted. The chimneys of these lamps are pipes leading to the external atmosphere, the air necessary to support the combustion being admitted through a small regulating valve. Stop cocks in the chimneys prevent the escape of air when the globes are opened to put in candles.

The timber roof of the chamber is 4 ft. 10 in. thick, and is strengthened by two horizontal timber girders, each 10 ft. thick at the top and 3½ ft thick at the bottom, and 9 ft. in hight. These divide the caisson into three nearly equal compartments, in the direction of the length of the bridge. Communication between these apartments is had through openings provided for the purpose.




THE CAISSON FOR THE EAST PIER OF THE ST. LOUIS BRIDGE.

### Trouble and Reward of Inventors in England.

The *Mechanics' Magazine*, in alluding to the complaints of an inventor who had placed, some four years ago, models and drawings of a ram for naval service, at the disposal of the British Admiralty, says: the inventor states that his designs were approved by Mr. E. J. Reed, then Chief Constructor of the Navy, but he, the inventor, has neither received, nor can he obtain, his model and drawings, or any straightforward answer as to the use that may be made of them. The editor alludes, also, to others who have like good grounds of complaint against Government for the manner in which they are treated; but there are others who are more fortunate, whether from the intrinsic merit of their inventions, or other influence, it is not for us to say. Government is very liberal to some inventors. We do not say that they will reward in turn the inventors of a rifle projectile with a hollow base, of a clay plug to fill the base, of an iron cup instead of the clay plug, and of a third, whose invention is simply "as you were," and abolishes cup and plug, restoring the projectile to its original form. If such a series of rewards have not been really paid, other awards not much more sensible have been made by the public departments.

Some of the inventors who have applied to the Ordnance departments have certainly been dealt with very liberally. Messrs. Henry & Martini can have no reason to complain. Mr. Snider and two others have taken no less than £16,000 for their plan of converting muzzle-load-

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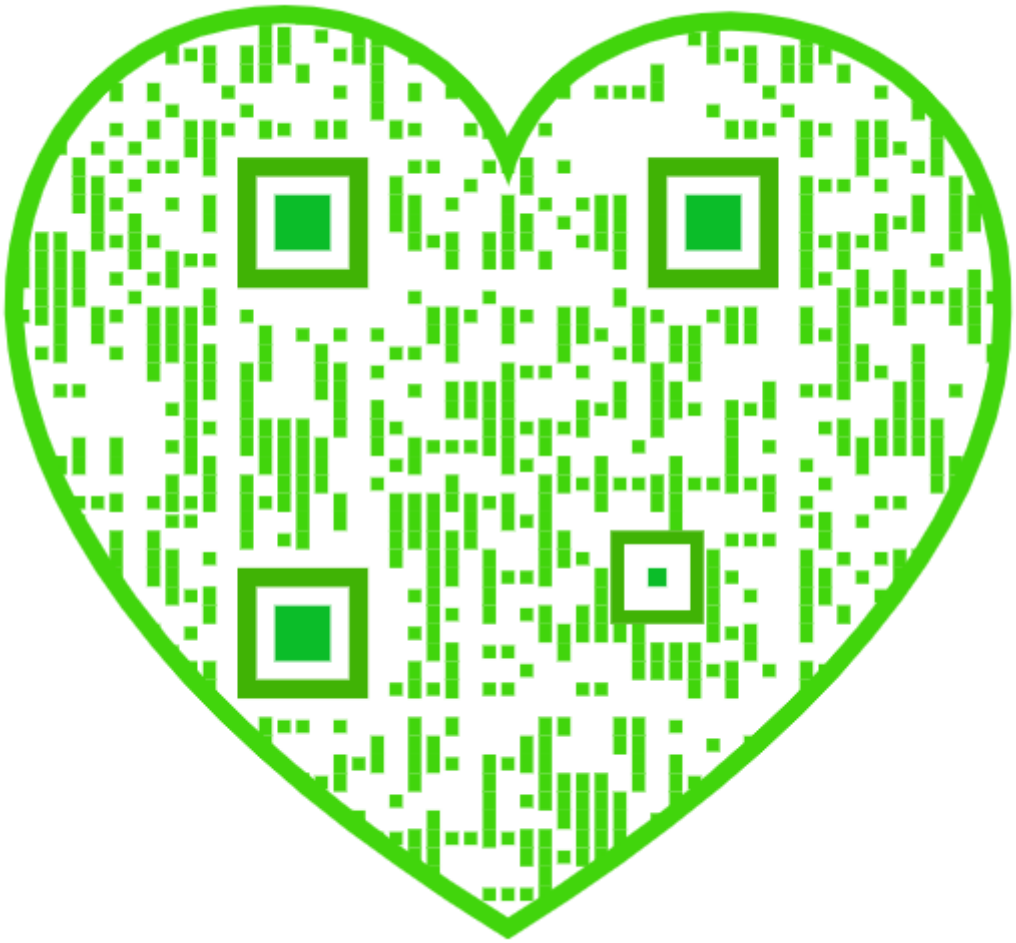

ing into breech-loading rifles. Major Palliser had £15,000 for his chilled projectiles, although the chill process was neither an invention nor a discovery, but simply the adaptation of a process employed many years previously at Ransome's Works, Ipswich (in casting chilled crossings), and others. The same gallant gentleman had £7,500 for his plan of converting cast-iron guns. Captain Moncrieff has had £10,000 for his gun carriage, has £1,000 a year salary, and will have £5,000 when his services are dispensed with. It cannot be supposed that the Admiralty or Ordnance Depart can award £15,000 or £20,000 each to all the inventors that apply to them, but they may surely, in accordance with fairness and common sense, deal with an inventor in a more honorable manner, than by official evasion and the retention of the details of his designs for four years, and by causing the public scandal of driving a respectable man to such a course for redress as we have been referring to.

It will be seen from the above that some of our American inventors have received handsome fortunes for their inventions in England.

### New Electrical and Other Experiments.

At a recent soirée of the Royal Society, London, three experiments by Mr. Cromwell F. Varley were exhibited for the first time in public. In a Geissler's tube, containing highly rarefied hydrogen, a small filament of talc was hung by a single horizontal fiber of silk. Two aluminium rings, separated an inch and a quarter, formed the electrodes inside the vacuum. This tube was placed longitudinally with and over the horizontal poles of a large, very powerful iron horseshoe electro magnet, made of a bar four inches in diameter, and four feet in length, and wrapped with nearly 2 cwt. of thick copper wire. A small induction coil sent electric discharges from one ring to the other, producing a brilliant blue light around the negative pole, the positive pole being dark. The moment the magnet was charged, by means of thirty cells of Grove's nitric acid battery, each cell containing twenty square inches of platinum foil, the electric luminosity in the tube, which beforehand was diffused, gathered up into an arch extending one and a half inches beyond each ring, forming altogether a well defined arch about four inches in length. This luminous arch follows exactly the course of those magnetic rays which traverse through the negative pole. By shifting the tube, the piece of talc can be brought at pleasure in or out of this luminous arch. Neither the electric action, nor the magnet *per se*, produce any motion upon the talc; but when the tube is so placed that the luminous arch strikes against the talc, the talc is repelled as much as 30° from the perpendicular. The electric current is passing simply from one ring to the other, inside the tube, but the luminous arch in question, where it strikes the talc, is on the other side of the ring, and where no electricity is flowing.

Mr. Spottiswoode's musical vibration experiment consisted of the visible representation of the forms actually assumed by a musical string when producing a note or its harmonies. To show this, it is required that the string should be kept in a perfectly uniform state of vibration. This was very ingeniously accomplished by means of tuning forks kept in vibration by electro magnets, these forming their own breaks in cups of mercury.

The singular action of nuclei in promoting crystallization has long been known; but recent experiments by Mr. Chandler Roberts, chemist of the Mint, have imparted additional interest to the subject. Minute traces of lead, antimony, bismuth, or arsenic, render the alloy of gold and copper known as "standard gold" crystalline, intensely brittle, and totally unfit for the purpose of coining. This remarkable effect is produced even when the amount of obnoxious metal does not exceed the $\frac{1}{1900}$ part of the mass of standard gold. Mr. Roberts exhibited beautiful specimens of crystalline standard gold, and illustrations of the process of toughening brittle gold by means of chlorine, recently introduced in the Mint, the adoption of which has afforded a satisfactory solution to a question of considerable importance, connected with the manufacture of coins.

### A Wonder in Weaving.

We hope our able cotemporary, the *Bureau*, is in its sober senses, and that much learning (or enthusiasm) has not driven its editor mad. It treats its readers, in its April number, to a loom story, which, if published on the first day of the month, would lead us to believe it was trying to "get even" with the public for sundry "sells," perpetrated upon it by mischievous correspondents. It says:

"The genius of invention, which has so ennobled the American name by important discoveries in other mechanical arts, has inspired the brain of a New England boy in this direction; and the ancient forms and usages of the weaver must now give way to a loom, in construction as remarkable for its progress and achievements in the manufacture of cloths as, in their several departments, were the inventions of Howe, Morse or Bigelow. The inventor is a Mr. Abel, of Vermont, and he calls his new machine the Weft-Thread Loom. We have studied its construction and operations, and can say to the more than seven hundred woolen manufacturers whom we address by our journal, that it is a most remarkable invention, and has imperative claims upon their attention; for it will, of necessity, revolutionize the main department of their industries. One fact alone will demonstrate this. A first-class Crompton loom will weave thirty yards of cloth a day. A machine of the weft-thread pattern of the same class, will produce, of equally good fabric, *three hundred yards daily!* The Abel loom is simple in construction, and can be made of any size required. For cloth of ordinary width, the extreme dimensions are five feet by six, or thereabouts. The movement is easy—a lad of fifteen being able, by a crank attachment, to supply power for several machines. It makes no more noise than a Wheeler & Wilson sewing machine, and runs as easily. Its motion is that of knitting and weaving combined. The yarn is taken direct from the bobbins, which are placed in a semi-circular form, close up to and forming part of the frame of the loom. On these bobbins the yarn is wound with ease and speed, on a machine invented for the purpose by Mr. Abel. There is no dressing, beaming, spooling, or warping; no use for harness, reed, or or shuttle. The warp or filling runs in from the same bobbin as the weft-threads, and the product of thirty yards per hour is so firm, strong and stocky, that it is almost impossible to rend it, and it cannot ravel; while in smooth, even surface it is the equal of any cloth we have seen made. To these advantages it adds that of economy in the saving of waste, to the extent of at least fifty per cent over any other loom in use. Its simplicity of construction will make its repairs easy and of slight cost. With these advantages, the machine weaves, also every variety of pattern in plain, fancy, ribbed and striped goods, and uses any material in silk, cotton, flax, or jute, as well of wool. In fact, the range of its production is from the coarse gunny cloth for cotton bales, to the most elegant cloths of our mills, East or West."

### Tests for Impurities in Gas.

Harris's *Gas Superintendent's Companion* gives the following easy tests for impurities in illuminating gas:

TEST FOR SULPHURETED HYDROGEN.

Dissolve a small quantity of acetate of lead, commonly called sugar of lead, in distilled or rain water, until the mixture is about the consistency of cream; dip into it a piece of writing paper, which hold a minute or two over a jet of gas (unlighted); if the paper be not discolored, the gas may be considered pure; but if a brown stain be imparted to it, the lime in the purifiers should be renewed. This test will detect the presence of sulphureted hydrogen in gas, if it contain one part in 20,000.

*Note.*—As this preparation of lead is an active poison, it should be used with caution, and labeled.

A solution of nitrate of silver and distilled water is a more delicate test than the above.

FOR AMMONIA.

Apply either litmus paper or yellow turmeric paper, reddened by vinegar, or any other weak acid, to a jet of gas, as above; if the blue color of the litmus paper return, or the color of the turmeric paper deepen to a brown, the gas contains a proportionate amount of ammonia.

CARBONIC ACID

may be detected by adding to water impregnated with the gas a few drops of sulphuric acid, when minute air bubbles of carbonic acid gas will be rapidly disengaged.

Another test is to pass the gas through a solution of pure barytes in the blue tincture of litmus, when, if carbonic acid be present, carbonate of barytes will be precipitated.

ATMOSPHERIC AIR.

The presence of atmospheric air in gas can be readily detected by collecting a portion of the gas over mercury, and then passing up, first a few drops of caustic potassa, and afterwards a drop or two of a solution of pyrogallic acid. If the liquid assume a blood red hue, oxygen, indicating the presence of atmospheric air, is mixed with the gas.—*Muspratt.*

BISULPHIDE OF CARBON.

By forcing, by means of an ordinary blowpipe, the flame of coal gas, for about a minute, on to distilled water containing a little acid chloride of barium, sulphate of baryta is formed, and the presence of sulphur in the gas thus proved.

### Manufacture of Alum--A New Method.

Alum is such an important salt in the industry of the world that any improvement in its manufacture is of great commercial and industrial interest. Mr. P. Spence, of Newton Heath, England, has, according to the New York *Mercantile Journal*, recently patented a process for utilizing what is known as Rodondo phosphate, a phosphatic clay, or, chemically speaking, a compound of alumina (clay) and phosphoric acid, obtained in the island of Rodondo, in the West Indies. This mineral is also obtained in other West Indian islands, and in other parts of the world. It is not pure, but the process under consideration enables the inventor to utilize the iron and other minerals it contains in combination with the phosphatic clay. The byproducts are chiefly compounds of phosphoric acid, useful as fertilizers.

The following process is substantially the one described in the specification: The inventor takes the mineral in pieces as it comes to hand, and calcines it in kilns, exposing it to a red heat, by mixing it with coal or coke, or he grinds it so that it will pass through a sieve of, say, twenty meshes to the inch. The mineral having been prepared by these means, it is placed in leaden vessels, and an equal weight of sulphuric acid, of specific gravity 1–6, added thereto, if the mineral contain twenty per cent of alumina, but only three fifths of its weight if it contain twelve per cent, and in similar proportions for other degrees of richness. Heat is then applied, preferably by blowing steam into the vessel containing the mixture; the mineral dissolves and the specific gravity rises. The inventor now cautiously reduces by water or weak liquors (obtained during subsequent parts of the process), constantly boiling until all is dissolved except the insoluble sediment, and the strength of the liquor becomes 90° Twaddle, or 1·45 specific gravity. The inventor then passes this liquor into a close leaden vessel, and distills it into vapor containing ammonia obtained from gas ammoniacal liquor, subjected to boiling by either fire or steam injected into the gas liquor, the quantity of the said gas liquor used being equal to 600 or 900 gallons to each tun of the mineral, according to its richness. When all the ammonia has been distilled into the mineral liquor, it is allowed to settle for a few hours, and then the clear solution (now at a strength or specific gravity of 1·4 or 80° Twaddle) is run off into lead coolers to crystallize the alum. It remains in these coolers for some days, with frequent stirring, in order to obtain all the alum possible, which may be purified by crystallization. When the mineral contains twenty per cent of alumina, about one and a half tuns of alum is said to be obtained from one tun of the mineral. The mother liquor, having deposited all the alum that can be obtained, is now chiefly a solution of phosphoric acid, with a small quantity of sulphate of alumina iron, and sulphale or phosphate of ammonia.

### Mountain Sickness.

M. A. Le Pileur, M. D., in his "Wonders of the Human Body," describes the effects produced upon the human system by ascension to high altitudes.

"Gay-Lussac, who in his balloon ascension rose to a hight of 22,956 feet in six hours, found his respiration disturbed and greatly accelerated, and having made no movement requiring exertion, he could only attribute this condition to the diminution of the pressure of the atmosphere. But in climbing mountains, the movement and efforts of walking are added to the influence of the hight; and when the difference in altitude in one day amounts to 6,560 feet, a notable acceleration of respiration and quickening of the pulse is observed, which in many instances is accompanied by a peculiar sense of uneasiness, which has been termed *mountain sickness.* The most remarkable symptoms are fatigue, or rather partial paralysis of the muscular system, and especially of the muscles of locomotion. This paralysis of the legs increases with every step, until, having gone a certain distance with increasing difficulty, it is impossible to take another step. A rest of a few seconds is sufficient for the muscles to regain their power, and it seems as if the traveller could go on without the fear of a recurrence of the difficulty; but very soon it returns, and a fresh halt is necessary. The higher one goes, the shorter the distance that can be passed without resting—from one hundred and fifty steps the distance falls off to one hundred—to fifty—and at last to twenty or thirty. Inclination to sleep, oppression of the heart, and loss of spirit, are sometimes added to this periodic exhaustion of strength, and in some persons mountain sickness is closely analogous to sea sickness. In others the symptoms are such as are always induced by the respiration, circulation, and, in consequence, in the muscular system, by violent exercise. Thirty steps in climbing a high mountain cause as much fatigue as a forced march or run of a much longer distance, on a plain. Respiration, quickened by motion and disturbed by successive efforts, is no longer sufficient for sanguification; the proportion between the venous and the arterial blood is no longer normal; and, above all, sanguineous congestion, which is inseparable from violent exertion, takes place in the lungs, in the brain, and other organs. But as soon as the muscles have relaxed for a few moments, two or three full inspirations rapidly relieve the congestion, while a flood of arterial blood proceeds from the heart to revive the whole organism."

### Aymara Indians in Peru.

A new undertaking of interest to the philosopher, is the Arequipa Railway, in Peru, just opened for traffic. It is a great engineering work, carried out with English capital by American enterprise, and it penetrates the western chain of the Cordillera of the Andes, to reach the table lands of the interior, Arequipa, the terminus, being 7,800 feet above the level of the sea. Now, at this elevation, the rarefaction of the air is such that the ordinary workmen could not be employed, the suffering being in some cases intense. The works were, however, pushed on with vigor, and Mr. Meiggs imported above 16,000 laborers for his works, and for this purpose, chiefly Aymara Indians from Bolivia. Mr. David Forbes, F. R. S., has, in his memoirs on the Aymaras, in the *Journal of the Ethnological Society*, described the abnormal structure of the chests of these people, and it is astonishing to see them employed in a task which most effectually insures their subjugation. To foreign troops it was always difficult to scale these regions, but now the railway does the work, though to soldiers and passengers the journey is not always without discomfort.

### Pawnbroking in Paris During the Siege.

Many curious facts of interest are coming to light, as to matters in Paris during the recent siege. For example: No one was allowed to borrow more than 50 francs on any article, no matter what its value might be. In spite of this, the pressure for money was so great that the store rooms of the Mont de Piété became encumbered with articles, which 150,000 persons of all classes had pledged. There were no fewer than 100,000 watches, and 25,000 clocks, diamond necklaces, and bracelets of fabulous values. There were also evidences of the distress to which persons of rank had been reduced—one piece of lace after the other, the last cashmere shawl, or a pocket handkerchief embroidered with a coronet, of such fine material that it was still possible to raise 3 francs, the lowest figure allowed, upon it; gentlemen's gold-headed canes, even ordinary riding whips, and no fewer than 2,000 opera glasses. No fewer than 2,300 poor wretches had pawned their mattresses, and starving seamstresses had pawned 1,500 pairs of scissors.

EXPERIMENTS recently carried on in India have proved that coffee pulp will yield, upon distillation, 9 per cent of its own weight of spirit, equal in strength to Scotch whisky Nothing is said as to the flavor of this spirit in its raw state, but it appears to realize on the spot a price nearly equivalent to 4s. 6d. per gallon.

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## THE PATENT LAWS.

Not fewer than three Bills are before the British Parliament, proposing to modify or abolish the Patent Laws. The cry for repeal, says the (London) *Building News*, has, for many years, come from the same quarter, and it is still contended that the abolition of patents would conduce to the advancement of arts and sciences. On the other hand, it is urged that this would put a dead lock upon the genius of invention. Now, between these two extremes, may we not find a middle term, as in logic ? And if not a middle term, then we are forced back upon the principle of patents. There are economists who protest against "property in ideas;" who would disendow the human mind; who would treat the contriver of a new machine as the Americans treat the author of an English book—thank him for his production—and steal it. A patent is granted for the mode, easier and cheaper than other modes, of achieving a particular result. It is as much the individual's property as an artist's picture, or a scholar's book. Take the method of boiling; you cannot patent heat, but you can patent the means of applying it. It is to the parts employed in working out the discovery that the Act of Parliament affords protection. When Mr. Smith patented the screw propeller he did not become possessed of the sole right to the idea of propulsion by means of a screw; other inventors obtained patents for varying patterns. So with the paddle-wheel. The feathering superseded the fixed float, and no legal privilege was infringed. But the extinguishment of this privilege would be the deadening of independent ingenuity. Who cares to work without a reward?—Who, especially among the poor, whose dreams, while they ply at their striving labor, are of reputation and success? As well might men publish books without copyright. An invention is not a commodity which can be produced at will. If we wish to have bread to eat we must till the ground; if we have corn to grind we must send it to the miller; we must sow the seed, reap the harvest, separate the wheat from the chaff, convert the grain into flour, and the flour into dough, and the dough into rolls and loaves; and we have the needful substance on our tables. But we are bound to think of the miller and his men. For centuries, dating from beyond Chaucer, they toiled in an atmosphere made unwholesome by the cloud from the grinding grain. Then stepped in the inventor, Bovill. He had devised a plan for increasing the efficiency of the millstones, while subduing the mealy dust. He patented it. But what the outcry? Exactly that which greeted Christopher Columbus when he had found out a new world. Anybody might have done it. Each miller could have made the discovery for himself "in process of time." But the process of time is a long one, occasionally. Three-fourths of the millers in England, for many years, neglected Bovill's improvements, as three-fourths of the engineers despised Watt's modifications of the steam engine. An eminent lawyer recently said—and it was a surprising thing for him to say—that all inventions will be made, some day or another, even if the patent laws be abolished. This we can neither disprove, nor accept without qualification. The qualification is that patent laws are good, not merely because the direct influence they have in the stimulating of invention, nor even that they act, in a manner, as premiums upon ingenuity, but because when the state has to deal with the demands of inventors, and has to take into account the interests of every section of the community, patent laws offer the most equitable arrangement for satisfying rival claims, while protecting the meritorious from pillage and ruin. It is urged that the laws of nature are common property? But is a peculiar unsight into these laws, common property. We do not suppose that Newton ever thought of patenting his law of gravity, or that a mathematician who squared the circle would register his triumph at the South Kensington Museum. Still, in our day, thousands upon thousands of discoveries, useful in their way, are the productions of poor men's thought, who cannot afford to give their time to enrich "the general fund of the world's wisdom." They do not ask for a perpetual prerogative of royalty in a screw propeller, a hydraulic press, a steam engine, or an electric telegraph; their want, in plain language, to gather in the first fruits of they intellectual industry; and they have a right to it. Why should the dull and indolent profit freely by the exertions of the acute and pertinacious? Where, under those circumstances, would be the natural human motive for exceptional effort? It is very easy to talk about the sacrifice of a few to the general good; yet where would the few be found unless they felt an incentive? It has been wisely written that there is really no great and continuous labor undertaken without some stimulus of a more special and personal kind than the self-satisfaction of contributing to the enjoyment or profit of our mortal race. We all denounce when a great inventor dies unrewarded. He has been looking keenly into the laws of nature; he has learned something of which we, hitherto, have been ignorant; he has won in a race for which many have started; and, forsooth, he is to be denied the prize because others might equally easily have won it ! For our own part, we can perceive no tangible distinction between copyright in a book and copyright in a mechanical or scientific invention—setting aside the discoveries in surgery and medicine, the disclosure of which is immediately due to all mankind. We cannot distinguish between the author of a work on the screw-propeller and the author of the screw-propeller itself. The book is a creation, and the novelty it treats of is an invention also; and why should not be protected? The history of discovery is a history of surprises. We do not say that patent laws are never abused. They are put in force for unmeritorious quackeries, and for copies of old specifications. But these abuses, upon the whole, correct themselves. There is no virtue in the words "by royal letters patent" which can permanently mislead the public. If these words were legally affixed to machines constructed to produce perpetual motion, they would hardly suffice to overcome those drawbacks due to friction and gravitation which have always hindered such engines from working so well in practice as they do on paper. Patents, justly understood, are the finger posts of progress. They are granted upon exactly the same principle as that which created our Indian and North American Empires. They are related to the spirit of monopoly, no doubt; but is not every man's private estate a monopoly? Is not every man's personal genius a monopoly? Was not Sir Walter Scott—was not our Charles Dickens a monopolist, in the most exclusive sense of the term? There is nothing in common between these particular prerogatives and, for example, the infamous monopolies created by Queen Elizabeth. The sovereign has no longer any power to bestow these rights. If they are falsely claimed, they can be cancelled; if they are grossly absurd, so as to include, at once, the propelling of ships, the making of shoes, and the cutting of turnips, they are, no matter what fees are paid, null and void. Still, we admit an injustice and a difficulty. Men who can really invent nothing, may be able to suggest a slight improvement actually suggested by some other man's work, the work of an original and fertile brain. Here the patentees compete unfairly: the greater gives way to the less. If a man discover the effect of the actinic rays of light on nitrate of silver, he becomes master of a new idea, and may, by publishing his discovery, make the public share in his knowledge. Another individual takes advantage of it, and produces a picture on a piece of glass or a sheet of paper. Or the one finds a bed of ironstone or a seam of coal, while the other contrives an apparatus for smelting. Which should be the patentee? Which should possess property in the idea? Clearly the one who can practically apply it. The discoverer enlarges our knowledge; the inventor increases our power; and the whole case stands this way: some manufacturers complain that they are hampered by patents, that they know not what to do lest they should infringe the rights of some monopolists whom they cannot compel, under any royalty, to grant a licence for making their apparatus or employing their processes. Against all this we have only to plead again, that industry and ingenuity must have their inducements and their rewards.

### Interesting Coal History.

The year 1820 marked the beginning of anthracite coal mining in this country. The population of the single county of Schuylkill and the tuns mined were as follows at the beginning of each decade since 1820:

| Years. | Population. | Tuns mined. |
|---|---|---|
| 1820 | 11,339 | 865 |
| 1830 | 20,784 | 89,984 |
| 1840 | 29,081 | 452,291 |
| 1850 | 63,205 | 1,712,007 |
| 1860 | 90,173 | 3,270,516 |
| 1870 | 133,000 | 4,748,969 |

The population and production of the same period, in the entire 170 square miles of anthracite coal lands, were as follows:

| Years. | Population. | Tuns mined. |
|---|---|---|
| 1820 | 20,000 | 865 |
| 1830 | 45,000 | 174,434 |
| 1840 | 70,000 | 864,384 |
| 1850 | 130,000 | 3,358,899 |
| 1860 | 220,000 | 8,412,946 |
| 1870 | 350,000 | 15,723,030 |

The amount of anthracite coal yet in the earth is as follows, the area and thickness of the veins being accurately known:

| | Square miles. | Depth of coal, yards. | Tuns. |
|---|---|---|---|
| Central coal fields | 126 | 15 | 5,854,961,000 |
| Southern coal fields | 146 | 35 | 11,308,842,000 |
| Northern coal fields | 198 | 15 | 9,179,872,000 |
| Total | 470 | .. | 26,343,675,000 |
| Deduct one half waste in mining | | .. | 13,171,837,500 |

Which leaves, of marketable coal, 13,171,837,500 tuns, or a deposit equal to an annual supply of 20,000,000 tuns for 600 years.

Within a circle of one hundred miles, of which Pittsburgh, in the western extremity, is the center, there is enough bituminous coal in the earth to pay off the national debts of all the governments of the world many times over. And it has been estimated, from geological surveys, that this coal would pay our national debt fifty-four times, if its stupendous value could be realized at once.

Far down in the mines (in some instances as much as 1,500 feet below the level of the rivers), we have, in the small anthracite region, more than 400 miles of railroad, not included in the aggregate of railways in the State. These subterranean railways would, if formed into one continuous line, reach from Boston to Washington, or they would form a double track from Philadelphia to New York, and back again. These facts are all the more remarkable, as the production of grain and gold was $6,000,000 less in 1870 than in 1869.

### Wooden Railways.

A correspondent recently wrote us condemning wooden railways, as difficult to keep in repair, and unprofitable unless the rails be protected by iron straps. The *Railroad Gazette*, however, gives the views of the President of the Clifton road (a description of which was published on page 104, Vol. XXI., of the SCIENTIFIC AMERICAN), regarding the working of that road, which presents the subject in a different aspect. He says that the company expect to move from 50,000 to 100,000 tuns of freight yearly, and that the rails will last five or six years. He also says that light trains have been run on that road at twenty miles an hour. It does not appear that any of the new wooden rails are mounted with iron straps, after the fashion of the old wooden roads, and it is doubtful whether that was any advantage. The writer had some experience, years ago, on a "strap road," and it then seemed that the strap was a damage, rather than a benefit.

Those who are about to build wooden roads will, no doubt, be interested to know in what way a bar of iron, two inches by one half inch, spiked to the top of a wooden rail, would be a damage. Firstly, there is the cost of the iron and spikes, and the expense of laying it, whatever that may be. After this is done, the first injury noticeable is the injury to the rails, caused by the spikes. The rails are frequently split, and the spikes soon work loose, leaving a space for water to enter, which causes the rails to decay rapidly; and, as the iron will not fit the wooden rail so snugly as to exclude water, the wood under the iron is constantly wet or moist, which causes the iron to force its way into the wood; and then in a very short time the bar will have settled its thickness into the rail, so that the portion of the tread of the wheel outside of the iron would run on the wood. We have noticed that, after a new rail had been in the track a few weeks, there would be a layer of pulp one eighth of an inch thick (or perhaps one sixteenth would be nearer the truth), between the strap and the rail, while that portion of the wood outside the strap remained sound. Of course this pulp was formed from the fibers of the wood, which had become separated by the action of the moisture, assisted by the vibration of the strap, while trains were passing, and was nothing more nor less than decay. We also noticed that the portions of the rails, outside the straps, that were acted upon by the tread of the wheels grew hard, instead of "pulping," like the portion under the iron. The rolling of the wheels on the wood had the effect to expel the moisture (on the principle of a clothes wringer), and to compress the fibers of the wood, and in a great measure prevent decay. It is doubtful about the straps strengthening the rail to such an extent as is generally supposed. A bar of iron one half inch, or five eighths inch, thick, laid flatwise, would of itself sustain only a light load; but, by reason of its continuous support by the wooden rail, would add considerably to the strength of the wood. But it is safe to say that the strap will not strengthen the rail sufficiently to warrant the expense of using it.

Another serious objection to the strap is contraction and expansion, which frequently renders it difficult to keep the track in a safe condition. We have seen these strap rails buckled and twisted by the force of expansion until they were torn from the track, resembling, in fact, a quantity of old harness strewn along the track.

Another trouble arising from the use of iron on a wooden rail, is what are usually called "snake heads." The action of heavy loads rolling over these flat bars is similar to that of the machines used for bending wagon tires, giving the ends of the bars a tendency to rise, drawing the spikes with them. It is exceedingly difficult, we may say impossible, to prevent this; and when the bar has once commenced bending, it seems to bend more rapidly, or the more it is bent the easier it bends, and pretty soon the bar is curled up in the form of a section of wagon tire. These are the "snake heads," and so long as they did not reach above the center of the wheels they were not regarded as dangerous; but as soon as a wheel struck one that had curved a little too much, there was mischief. Those who have never witnessed a wheel running under a snake head can scarcely imagine its effect. A twenty-foot bar of iron, wriggling its way through a well-filled passenger car, has, on more than one occasion, resulted in the mangling of as many human forms as in some of our first-class "smash ups."

To all these charges, against the strap rail, may be added the expense of track repairs, which will obviously be much greater with than without the iron. From the nature of the combination of the wood and strap rail, it is necessary that it be kept in good repair. Of course, this is important on any railroad, but a slight derangement of the strap road would be dangerous, and such a road would need constant watching, and would require a larger number of men to keep it safe than a well built wooden track without the straps.

And, finally, if cheapness be the main reason for building a wooden railroad instead of an iron one, the less iron used within reason, the better.

### Snakes.

Dr. Fayrer, in India, has been experimenting to correct the popular error that a snake cannot kill a snake. He took a young and very lively cobra, fourteen inches long, and which was bitten in the muscular part of the body by a krait forty-eight inches long. The krait had not bitten for some days before. From a detailed report by Dr. Fayrer, it appears that the cobra was bitten at 12.50 P. M., at 1 P. M. it was very sluggish, and 1.3 P. M. so sluggish that it moved with difficulty, could be easily handled, and made no effort at resistance. At 1.20 it was apparently dying, and its movements were scarcely perceptible, and at 1.22 it died, thirty-two minutes after the attack. Dr. Fayrer has found that the water snakes of India are deadly poisonous. In the Bay of Bengal they swarm, and it is noted as ominous that lately it was proposed to erect a sea bathing establishment at Calcutta, under the assurance there were no sharks. It is remarked that sharks need not be noticed when a bather may have deadly water snakes swimming after him.

PROF. NAUCH, of Riga, has discovered that thin glass tubes, when they have a ball blown at their ends, give out a distinctly audible and clear note on cooling, so long as the relation of the size of the ball to the length of the tube does not pass a certain limit. The sound is ascribed to vibrations set up by the inrush of air consequent upon cooling.

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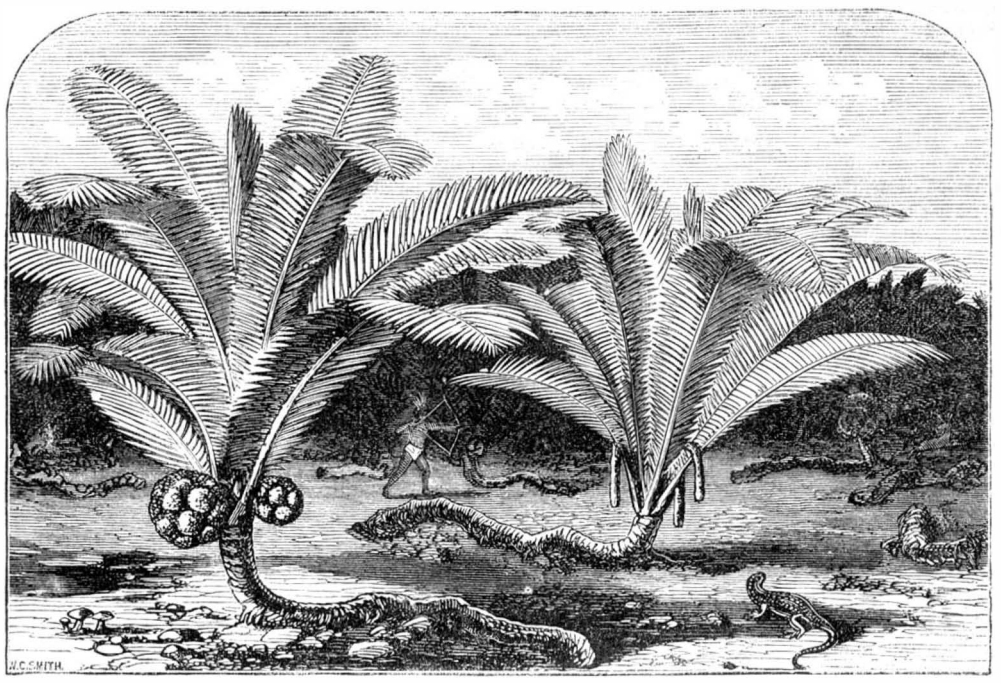
## THE IVORY PLANT.

So different are the products of the animal from those of the vegetable kingdom, that even the most careless observer may be expected at once to distinguish them. Yet multitudes are in the daily use of ivory buttons, boxes, and small ornaments, who never doubt that they are made from the tusks of the elephant, while they are really the product of a plant.

The ivory plant is a native of the northern regions of South America, extending northwards just across the Isthmus of Panama, large groves of it having been recently discovered in the province of that name. It is found in extensive groves—in which it banishes all other vegetation from the soil it has taken possession of—or scattered among the large trees of the virgin forests.

It has the appearance of a stemless palm, and consists of a graceful crown of leaves twenty feet long of a delicate pale green color, and divided like the plume of a feather into from thirty to fifty pairs of long narrow leaflets. It is not, however, really stemless, but the weight of the foliage and the fruit is too much for the comparatively slender trunk, and consequently pulls it down to the ground, where it is seen like a large exposed root, stretching for a length of nearly twenty feet in old plants. The long leaves are employed by the Indians to cover the roofs of their cottages.



THE IVORY PLANT.

Each flower of the ivory plant does not contain stamens and pistils, as in most of the British plants, but, like our willows, one tree produces only staminal flowers, while another has only pistillate ones. Such plants are said by botanists to be dicecious. Both kinds of the plants of the vegetable ivory have the same general appearance, and differ only in the form and arrangement of the flowers. In the one kind an innumerable quantity of staminal flowers is borne on a cylindrical fleshy axis, four feet long, while in the other a few pistillate flowers spring from the end of the flower-stalk. Each plant bears several heads of flowers. Purdie, who visited the plants in their native locality in 1846, says: "the fragrance of the flowers is most powerful, and delicious beyond that of any other plant; and so diffuse, that the air for many yards around was alive with myriads of annoying insects, which first attracted my notice. I had afterwards to carry the flowers in my hands for twelve miles, and though I killed a number of insects that followed me, the next day a great many still hovered about them, which had come along with us from the wood where the plants grew."

The group of pistillate flowers produces a large roundish fruit, from eight to twelve inches in diameter, and weighing when ripe about twenty-five pounds. It is covered by a hard woody coat, everywhere embossed with conical angular tubercles, and is composed of six or seven portions, each containing from six to nine seeds. These seeds, when ripe, are pure white, free from veins, dots, or vessels of any kind, presenting a perfect uniformity of texture surpassing the finest animal ivory; and its substance is throughout so hard, that the slightest streaks from the turning-lathe are observable. Indeed, it looks much more like an animal than a vegetable product; but a close comparison will enable one to distinguish it from the ivory of the elephant, by its brightness and its fatty appearance, but chiefly by its minute cellular structure.

This curious hard material is the store of food laid up by the plant for the nourishment of the embryo, or young plant contained in the seed. It corresponds to the white in the egg of the hen, and has been consequently called the albumen of the seed. In its early condition this ivory exists as a clear insipid fluid, with which travellers allay their thirst; afterwards the liquor becomes sweet and milky, and in this state it is greedily devoured by bears, hogs, and turkeys; it then gradually becomes hard. It is very curious that this hard mass again returns to its former soft state in the process of germination. The young plant for some time is dependent upon it for its food, and if the seed be taken out of the ground after the plant has appeared, it will be found to be filled with a substance half pulp and half milk, on which the plant lives until it is old enough to obtain its food on its own account.

From the small size of the seed, the largest not being more than two inches across its greatest diameter, the vegetable ivory can be employed in the manufacture of only small articles, such as beads, buttons, toys, etc. What is wanting in size is, however, often made up by the skill and ingenuity of the workman, who joins together several pieces so as to make a long object (especially when such articles are made by the turning-lathe, when it is easy to hide the joints from view), or makes a lid from one seed, and the box from another, In some years as many as 150 tuns of seeds have been imported into England, and they have been sold in the market at the rate of a thousand nuts for seven shillings and six pence.

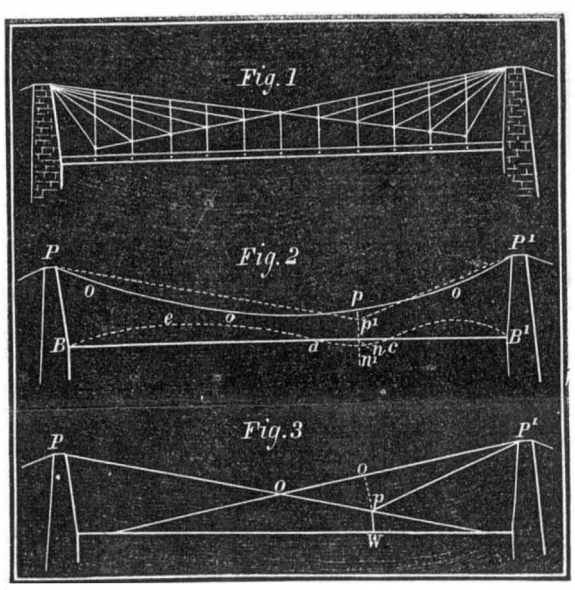
### American Supply of Arms to France.

Since the commencement of the Franco-German war, France has been the principal purchaser of arms in the markets of the United States. Since the capitulation of Marshal MacMahon, at Sedan on September 3, and the proclamation of the French Republic on September 5, 1870, the shipments of small arms have been very large, amounting in value, between September 3, 1870, and January 4, 1871, to $9,717,606. The *Pereire,* in three trips to Havre, tooks guns worth $1,432,904; the *Lafayette,* in three trips, took guns worth $2,171,395; and the *Ville de Paris,* in two trips, took guns worth $1,927,263. The steamers *Erie, Ontario,* and *Avon,* sailing to Cowes for orders, each carried a cargo of arms valued in the aggregate at $4,216,008. A manufacturing firm in New York, it is stated, has been turning out daily 1,000 muskets of an improved pattern for the French Government. Of the guns shipped, 75,000 were Enfield rifles, originally imported from England, and disposed of last autumn by the United States Government at the public sales by proposals. A large surplus of arms sold on that occasion are not yet delivered, the purchasers being agents of the German Government, and having forfeited the deposit of $10,000 for non-compliance with the conditions of sale.

The shipments of artillery to France were small, the value amounting in the aggregate to $150,000. Harness in considerable quantities appears on the manifests of vessels sailing for Havre, and over 50,000 knapsacks have also been shipped to that port. In September, the *Lafayette* took out a shipment of arms. Early in the second week of January, a cargo reached Bordeaux in the *Lafayette,* from New York, consisting, among other warlike items for the French Government, of 43 field guns; 150,000 stand of arms, being Remington and Springfield rifles; 217 chests of artillery harness, 3,318 chests of rifle ammunition, 4,671 chests of the same of a different make, 6,993 barrels of gunpowder, 56 chests of revolvers, 76 chests of cavalry sabers, and a large quantity of lead and copper.

### TRIANGULAR SUSPENSION BRIDGE.

The *Journal of the Franklin Institute,* for February, contains diagrams of a method for the construction of suspension bridges, which appears to us a decided improvement upon methods hitherto used. We have therefore reproduced these diagrams upon a small scale for the benefit of our readers. Fig. 1 illustrates the general method proposed, that is, the construction of a bridge in which the cables shall follow straight lines instead of curves, as hitherto.




Figs. 2 and 3 will illustrate the principle more fully. In Fig. 2, P *o o* P′ represents the cable of the usual suspension bridge, and B B′ the roadway. When any extra weight is brought upon the bridge at any point, as *n*, the roadway at that point is depressed, say to *n′*, the point *p* descending to *p′*; from the points *c* and *d* to each end, the roadway is elevated; between the points it is depressed. The cables tend to the lines P *p′* and P′ *p′*, while the roadway tends to assume the form B *e d n′ c* B′. This variation, in the forms of the cable and roadway lines, moves from point to point along with the extra weight. To obviate this, a heavy truss is generally used. Now, in Fig. 3, if the weight be transmitted in a vertical line to *p*, thence in straight lines to P and P′, there can be no depression. The roadway will remain firm. This principle, of transmitting the weight directly, and in straight lines to the points of support, is the main feature of the bridge.

It will be seen on examination of Fig. 1, that the weight at any point of the bridge will be transmitted by the vertical cables or rods directly to their points of junction with the obliquely descending rectilinear cables or rods, and from the points of junction in right lines to the towers. Whatever deflection occurs, must therefore arise only from the stretching the cables, all the undulatory effect of heavy strains being entirely eliminated.

### Railroading in the Olden Times.

William Hambright, an old conductor on the Pennsylvania Central road, who, we are told, is familiarly known throughout the State as "Cap," "Cappie," "Pap," or "Conductor Hambright," has given to the Columbia (Pa.) *Courant* some account of his experience.

Mr. Hambright commenced his career as conductor by taking the first train (horse cars) out of Lancaster, in 1833, after which time he ran regularly, and has been employed nearly all the time since as passenger conductor on the Pennsylvania Central Railroad. He then acted as conductor, brakeman, and greaser; his compensation was eighteen dollars per month—which was considered good wages at that time. His train of horse cars would leave Lancaster at five o'clock, P. M., and arrive at Philadelphia at five o'clock the next morning, making twelve hours for the journey; and the fare charged was $3·50. Stoppages were frequent, fresh horses being employed every fifteen or twenty miles. At times they would be greatly detained by the severity of the weather, the winters in those times being much colder than at the present day.

There was no fire in the cars, and when a stop was made to change horses, the conductor would make for the nearest haystack or barn for the purpose of procuring straw or hay to strew upon the floors of the cars in order to make his passengers more comfortable; he riding outside, the cars generally being packed so full that he could scarcely gain admission. Down grade the horses were always kept at a full run. Horseflesh was very cheap then—sometimes five good animals could be purchased for $100. In the year 1835 a locomotive, built by Norris, was brought from Philadelphia to Lancaster, in wagons (why it was not brought by rail we did not learn); however, the wonderful machine was put upon the track and fired up in presence of an immense assemblage of spectators. It appears the enterprise was not very successful, as it would run a short distance and then halt; then a number of muscular men would lend their assistance by pushing. Every device was resorted to, to make the "critter" go, but to no purpose. Some time after this, three small engines were purchased in England and sent over, which answered all the purposes for which they were intended, one of which is in use at the present time in York, Pa., sawing wood.

The Harrisburg and Portsmouth Railroad, as it was then called, being laid upon strong pieces of wood, using flat bar iron fastened down with spikes—it was necessary to carry hammer and spikes on the engine. Very often spikes would come out from the end of the bar, causing the end of the same to stick up, which were termed "snake heads," and the engineer would be obliged to stop and spike down before attempting to pass over. Information had to be given the engineer, before starting, where stops were to be made.

Here we may state that to Mr. Hambright belongs the credit of inventing the bell and rope system for signalling engineers. He got permission from his "boss" to put his idea of the thing into practicable shape. Procuring a rope and common door bell, he attached the latter near the engineer—no house being over the locomotive at that time—and then stretched the rope over the top of the cars. Ever after that, and up to the present time, bell ropes have been in vogue, though in a more approved style than the one just described.

Conductors were not required to make reports at the end of each trip, as is now practiced; they would hand over the gold and silver—perhaps two or three hundred dollars or more—to the clerk, who would enter it in a book provided for the purpose, somewhat in this wise: "Conductor Hambright, so many dollars," and that was all the formality about it. Checks for the baggage were not used, but when the cars arrived in Columbia or Philadelphia, the conductor would open the car door for the delivery of baggage, etc., to the passengers, who crowded around and secured their parcels by answering, "mine," to the conductor's interrogatory, "whose trunk is this?" which was kept up until all disappeared. If a trunk was marked "B" it was to go by boat; if "S," it was to go by stage line. Strange to say, there was not as much baggage lost then as now.

Very often the conductors would help the proprietors of the lines during harvest, and assist at other labor when off duty.

SHILLINGS were first coined, in England, in the year 1507

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### The Water Works of Philadelphia, Pa.

We are indebted to Frederic Graff, Esq., Chief Engineer of the Water Department of Philadelphia, for a copy of his annual report for 1871, which contains interesting information.

"The supply of water distributed during the past year has been much greater than any previous year. The average daily supply from all the works, for the whole year, has reached 37,149,385 gallons. The average supply for the month of July was 46,008,735 gallons per day—and the maximum supply of any one day was on July 20, 1870, when 54,655,509 gallons were delivered. This was equal to 81 gallons per day for each one of the population of the city per last census; but our citizens do not all get a supply from the works, many in the rural wards obtaining water from springs and wells. The water supplied on that day was equal to $92\frac{3}{10}$ gallons for each of the population who actually receive water from the works, and 540 gallons for each of the water tenants now upon our books; of course, no one can believe that each man, woman, and child of the population supplied, consumed for their actual wants $92\frac{3}{10}$ gallons a day; therefore, the immense amount wasted must be evident.

"The increase in the water supply is in much greater ratio than the increase of population. This occurs, probably, on account of the multiplication of modern conveniences for using water; such as water closets, wash basins, stationary wash tubs, wash pavements, and the increased number of each now considered necessary or desirable in our dwellings; besides the moer lavish discharge of waste water into drains and sewers than formerly—whereby it can be wasted without fear of detection.

"Whilst the supply of water delivered in our city is as copious as that of any other in the United States, the price charged for it is very much lower; a very trifling increase in some of our charges, for what may be considered as the "luxuries of water supply," and which would scarcely be felt as onerous, would enable us to make a marked increase in our revenue, and a corresponding decrease in direct taxation.

"Over 26 miles of distributing pipe have been laid, including mains of 30 and 36-inch diameter, making the aggregate amount of mains and pipes used in distributing the water $488\frac{1}{2}$ miles, a greater amount, by nearly 150 miles, than any other city in the United States, and only exceeded in the world by the city of London.

"A LARGE SUBMERGED WATER MAIN.—It was decided to use the Belmont Reservoir for the supply of the high wards on the east side of the river, particularly the 20th and 28th Wards; to do this, it became necessary to cross the river Schuylkill with the main, and it was decided to use a sub merged pipe, designed and patented by John F. Ward, of Jersey City, N J.; a contract was accordingly made with that gentleman, and the main has been successfully laid.

"It is 36 inches in diameter, has a movable joint of simple and peculiar construction which admits its being sunk length after length, from scows, by suitable skids and derricks.

"The inside of the bell of the pipe is turned smooth to a spherical form, the small end of the pipe having grooves in it to retain the lead; when two pipes are put together, a lead joint is cast and caulked in the ordinary way. The smoothness and form of the inside of the bell permit the requisite motion, the lead joint slipping upon that, whilst it is retained firmly by the grooves in the small end of the pipe.

"The total length of the pipe is 963 feet, and the deepest water 25 feet; at each side of the river, at the shore ends, a suitable channel was dredged to receive it."

### Progress of Ignorance.

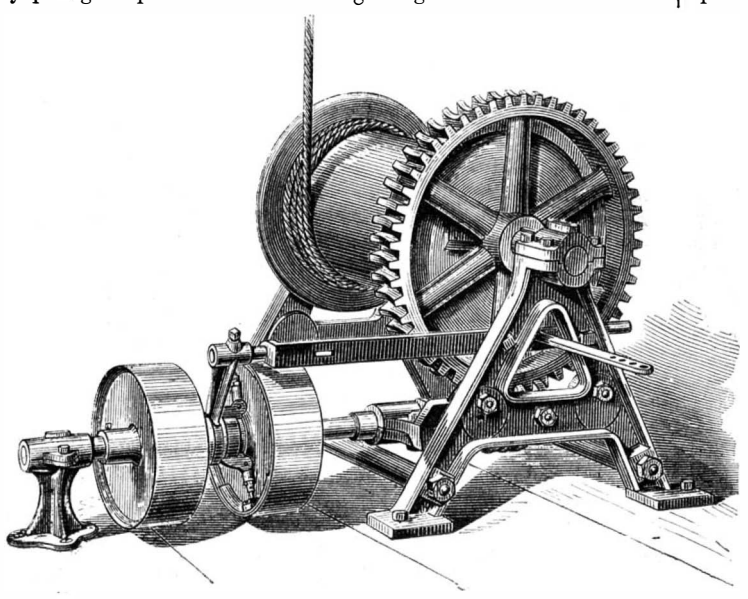
We read in the London *Builder* that a "civil engineer" recently wrote to an English government department, on the subject of the ill-fated ship *Captain*, and in his letter remarked "that a good deal had been said about the center of gravity of the vessel, but the fact was that no hollow bodies could have any center of gravity."

This will disturb the gravity of our readers, and afterwards, in their serious moments, they will agree with us that some examination ought to be made of persons intending to practise engineering, as it is of candidates for the admission to the ranks of medicine, law, and divinity. The term "civil engineer" would then present some definite idea to our minds; at present, it may mean anybody, from Robert Stephenson or I K. Brunel, down to the abovementioned theorist, who seems unconscious of the existence of a center of gravity in his own head.

AMERICAN INSTITUTE OF ARCHITECTS.—LECTURES.—An experimental course of lectures is in progress, before the New York Chapter of the American Institute of Architects, on Mondays and Wednesdays of each week, the course to end on May 31, 1871. The lectures are given by Mr. P. B. Wight and Mr. R. G. Hatfield alternately, the former discussing the History and Æsthetics of Architecture, and the latter, Architectural Construction. Tickets for the course are sold at $10. The lectures commence at 8 P.M., at 925 Broadway (near Twenty-first street).

### IMPROVED POWER HOISTING MACHINE.

This machine is designed for elevators and other hoisting purposes, where it is desirable to hoist, and also lower, loads at a regular uniform speed. In the machine illustrated in the accompanying engraving, the desired result is accomplished by the worm and worm gear on the drum shaft. The worm is driven in opposite directions, by means of two friction couplings, with cross and open belts, which operate smoothly in connection with the worm and gear, and are almost entirely noiseless in working, raising or lowering loads with great steadiness. By means of the worm and gear, great power with minimum gearing is secured. The friction

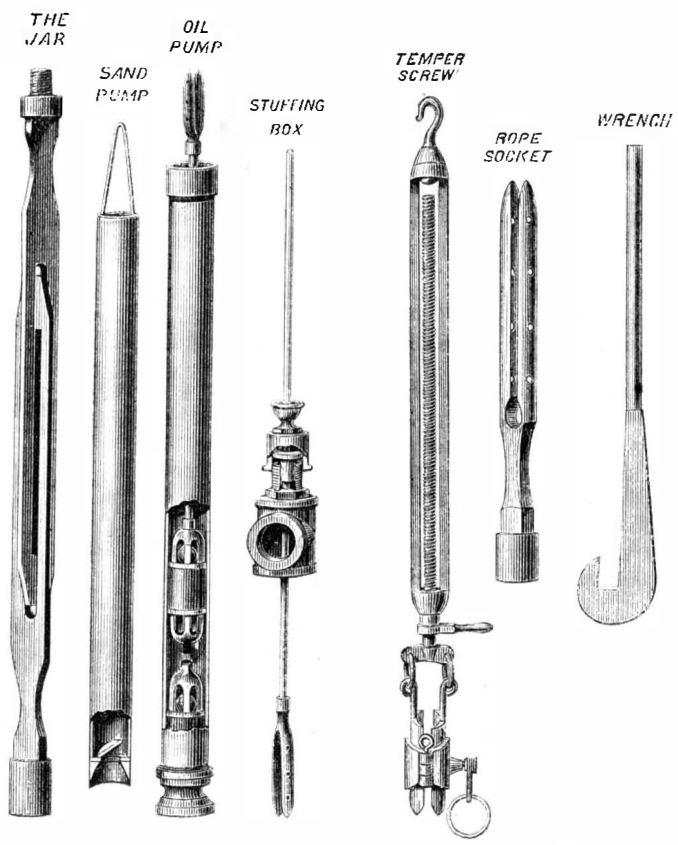


couplings operate quickly, and save all shifting of belts, and also always have the full width and power of the belts on the pulleys. The two main bearings of the worm shaft, on each side of the worm, are made of extra length so as to be durable, and are also both connected or cast in one piece, so that they cannot get out of line. They are also bolted to the main frame, which keeps both shafts in the proper relative position, without danger or liability of loosening, as frequently occurs where the main bearings are separately bolted to the wood framework of elevators. The iron frame is compact and stiff in form and easily set up.

The friction clutch pulleys, as used in connection with the worm and gear, constituting the driving and reversing mechanism of the machine, were patented February 25, 1869. These machines are manufactured by Volney W. Mason & Co., Providence, R. I.

### BORING FOR OIL.

The following description of tools and methods employed




in boring for oil in Pennsylvania is extracted from Blake's "Notices of Mining Machinery":

The discovery of petroleum in quantities in Western Pennsylvania, West Virginia, Ohio, Canada, and other localities, has given a great development to the art of well boring in the United States. The cumbrous pole tools have been rejected, and the cable, upon the ancient Chinese system, substituted.

The great advance has been in the construction of the tools, and in the adoption of simple apparatus for giving motion to the drill by means of steam power. For prospecting and for sinking co moderate depths of 50 to 150 feet, the spring pole, worked by hand, is frequently employed. This was the apparatus chiefly used in California a few years since, when the oil regions were prospected.

The constructions in common use in Pennsylvania at the oil wells, and used for a time during the oil excitement in California, consist of a derrick, bull wheel, band wheel, sansom post, and walking beam, and a portable steam engine. The descriptions and dimensions given below represent the average as determined by experience.

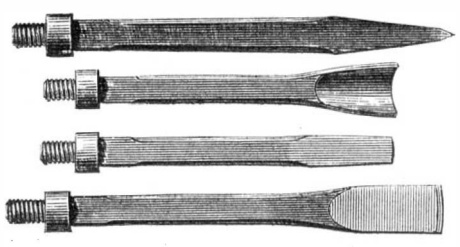
The derricks are usually constructed of plank and boards, when they can be obtained, or of unhewn poles. They rise to a hight of 50 or 60 feet, and taper upwards from a base about 15 feet square. The standards are of 2-inch plank, 8 inches wide, and the cross braces 8 inches wide and 1 inch thick. The tools are suspended by the cable, which, passing over the pulley at the top, descends at the side, and is wound upon the drum of the bull wheel, the shaft of which rests on bearings in the standards. The drum of the bull wheel is about 10 inches in diameter.

The walking beam, of wood, 26 feet long, is supported at the center, upon the top of the sansom post. One end is connected, by a pitman, with a crank of 22 inches radius upon the end of a shaft, receiving motion by a belt from the engine; the other end, projecting within the derrick, and directly over the well, carries suspended, the temper screw to which is attached a clamp for seizing upon the rope. The rotation of the crank shaft gives a reciprocating motion to the end of the beam, and this is imparted to the rope, carrying the tools at its lower end.

The form of the temper screw is shown by the gure. By this, the drill may be lowered or "fed out" to a certain extent during the progress of boring. The rope is seized and held fast by the clamp, and when the whole length of the screw is fed out, the position of the clamp is changed.

The drilling tools consist of center bits, reamers, an auger stem, sinker bar, and the "jar," besides a socket for attaching them to the lower end of the rope, and wrenches and other accessories to aid in attaching and unscrewing the bits. There are, besides, a variety of tools for recovering broken bits or other parts of the apparatus lost in the well, and sand pumps for removing the *débris*.

BITS AND REAMER FOR DRILLING



The bits are represented by the annexed cuts. They are $3\frac{1}{2}$ inches broad on the face, and the reamers are $4\frac{1}{2}$ inches. They are made, however, of various sizes, and all have strong, square shanks, so that they may be firmly screwed into the auger stem, made of $2\frac{1}{4}$ inch iron and 20 feet long.

The "jar" is a contrivance by which the auger stem and bit are, in a measure, detached from the rope. By it a blow or sudden jerk may be given upwards, so as to loosen the bit, in case it becomes wedged in the hole, while the same device serves to give a blow downwards upon the auger, after the bit strikes the bottom, thus doubling the efficiency of each stroke. It serves, also, to maintain the tension of the rope during the stroke. These jars are made of $1\frac{1}{4}$ inch iron on the sides, with 12 inch heads and 18 inch stroke.

The sinker bar, 10 feet long, is attached by a screw to the upper end of the jar, and above this is the rope socket, securely united, by means of rivets, to the end of the rope.

The bits and other parts of the drilling tools are connected and disconnected by means of two large wrenches, 3 feet 9 inches long, with broad flat heads, shaped as shown in the figures.

The drilling ropes or cables vary from $1\frac{1}{4}$ inch to $1\frac{3}{4}$ inch diameter, and weigh from 48 pounds to 86 pounds per 100 feet.

The sand pumps, made of heavy sheet iron or galvanized iron, sometimes of copper, are about 5 feet long, and from 3 to 4 inches in diameter, and are fitted with leather valves resting upon iron seats, as indicated at the lower end of the figure.

These tools, and the iron fittings for the walking beam wheels, and other parts of the apparatus for well boring, are manufactured by Messrs. Hart, Ball & Hart, of Buffalo, N. Y. The steam engines in use are portable, and generally 8 or 10 horse power. A 900 feet well can be drilled with an 8 horse power engine. Rope for a well 900 feet deep, with the tools, will weigh about 800 pounds.

Before commencing to drill, it is usual to drive down a cast-iron pipe through the loose soil and alluvial deposits until the firm bed rock is reached. These pipes are made in lengths of 8 feet, and are from 5 to 6 inches in diameter. They are joined together, end to end, by means of wrought iron bands carefully welded, and sized to shrink on to a shoulder turned upon each end of the pipe in a lathe, so that a flush joint is formed by the band. The lower end is made sharp, and the band is edged with steel. This form of joint has been patented by Mr. Bolles, whose name it bears, and it gives great satisfaction. The 5 inch lengths weigh 55 pounds per foot, or 440 pounds in all; and the 6 inch, 69

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pounds per foot, or 552 pounds per length. For lining the wells, wrought iron tubing is used, made with screws and sockets, or with flush joints, but always smooth finished inside. The sizes vary. For the light kinds, from 1½ to 4 inches for the inside diameter, and from 1·66 pounds to 6 pounds per foot. The heavier tubing ranges from 1½ inches in diameter, and 2·70 pounds per foot, to 6 inches, weighing 18·7 pounds per foot. These large sizes are seldom used for oil wells.

Pumps are made of wrought iron pipe, lined with heavy seamless brass tubes bored perfectly true, or of heavy brass tube alone. One of the last-mentioned construction, 5 feet long, is shown by the annexed figure, in which a portion of the interior is seen with the two valves and boxes. These valves are made of gun metal, and are fitted with great care. The packing is made of the best oak-tanned leather. Ball valves are generally used. The pump here represented is manufactured by the Messrs. Hart, and they have made an improvement upon the ordinary construction, by which the lower ball valve may be loosened from the top of the guard over the valve seat, to which it sometimes becomes attached by the accumulation of a deposit. A projecting point at the bottom of the upper box enters the hole in the top of the lower box, and thus forces down the ball. The portion of this projection nearest to the box has a screw thread cut upon it, and may be screwed into the box below, so that they may both be drawn out together. The pump barrels are usually 5 feet in length.

At the top of the well a stuffing box and elbow pipe is fitted. The construction of this box and the form of the joint for attaching to the sucker rods is shown in the figure. The stuffing is kept in place, and is pressed firmly upon the plunger rod or piston by means of the follower, made of brass. The plunger rods are 5 feet long, are made of 1 inch diameter cold-rolled iron, and are perfectly polished.

One other important adjunct of a complete oil well is the seed bag, the use of which is to form a water-tight joint or packing around the tube or lining of the well, and thus shut off all communication between the water of the upper strata and the oil-bearing crevices or chambers below.

This bag is made of leather, and is filled with flax seed. It is put around the tube, and is pushed down to the proper place, and soon becomes so much swollen by the absorption of water that it fills the space between the tube and the walls perfectly, and thus shuts off all communication around the tubing, for either water or oil from above or below.

### Useful Recipes.

TO MAKE FURNITURE OIL.—Take linseed oil, put it into a glazed pipkin with as much alkanet root as it will cover. Let it boil gently, and it will become of a strong red color; when cool, it will be fit for use.

TO GET OIL OUT OF BOARDS.—Mix together fuller's earth and soap lees, and rub it into the boards. Let it dry, and then scour it off with some strong soft soap and sand, or use lees to scour it with. It should be put on hot, which may easily be done by heating the lees.

TO PREVENT THE SPLITTING OF LOGS AND PLANKS.—Logs and planks split at the ends because the exposed surface dries faster than the inside. Saturate muriatic acid with with lime, and apply like whitewash to the ends. The chloride of calcium formed attracts moisture from the air, and prevents the splitting.

SILVERING IVORY.—Immerse a small slip of ivory in a weak solution of nitrate of silver, and let it remain till the solution has given it a deep yellow color; then take it out and immerse it in a tumbler of clear water, and expose it in the water to the rays of the sun. In about 3 hours the ivory acquires a black color; but the black surface on being rubbed soon becomes changed to a brilliant silver.

TRANSPARENT CEMENT.—Dissolve 75 parts India-rubber in 60 parts of chloroform or benzine, and add, to the solution, 15 parts of mastic.

*Another.*—Balsam of fir is a strong cement when not exposed to heat. It is to be warmed and applied to the glass, itself previously warmed. It is used for cementing lenses, mounting microscopic objects, etc., and does very well for broken glass which is not to be washed in warm water. The thicker the balsam, the stronger; when too thin, it may be thickened by gentle evaporation.

NEW GUTTA-PERCHA CEMENTS.—For uniting sheet gutta-percha to silk or other fabrics; Gutta-percha, 40 lbs; caoutchouc, 3 lbs; shellac, 3 lbs; Canada balsam, or Venice turpentine, 14 lbs; liquid styrax, 35 lbs; gum mastic, 4 lbs; oxide of lead, 1 lb.

For uniting sheet gutta-percha to leather, as soles of shoes, etc.; Gutta-percha, 50 lbs; Venice turpentine, 40 lbs; shellac 4 lbs; caoutchouc, 1 lb; liquid styrax, 5 lbs.

In making the cements the Venice turpentine should be first heated; then the gutta-percha and the shellac should be added; the order in which the other materials are added is not important. Care should be taken to thoroughly incorporate them, and the heat should be cautiously regulated, so as not to burn the mixture.

### Instruction in Industrial Drawing Free of Charge.

The state of Massachusetts last winter enacted a law which requires all cities and large towns to furnish free instruction in industrial drawing. The city of Worcester has perhaps made the best beginning. Upon opening the class, more than two hundred made application, and one hundred and forty-five were admitted, of whom nine were women. The lessons are an hour and a half long, and are given semi-weekly by Professor Gladwin, Professor Alden, of the Free Institute, and Mr. Higgins, superintendent of the Washburn Machine Shop, with some assistants.

In respect of occupation, there were of machinists, 42; carpenters, 26; pattern-makers, 7; teachers, 9; masons, 3; farmers, boot and shoe makers, clerks and architects, 4 each; organ builders, book-keepers, painters, armorers, and engravers 2 each; insurance agents, civil engineers, upholsterers, moulders, wire-drawers, blacksmiths, 1 each; miscellaneous, 24.

## Correspondence.

*The Editors are not responsible for the opinions expressed by their Correspondents.*

### Impurities in White Lead.

MESSRS. EDITORS:—Your correspondent, Felix McArdle, in your issue of March 18th, describes an interesting process whereby the purity or impurity of white lead, ground in oil, may be determined.

If you think the subject worthy of further consideration in your columns, I beg leave to narrate the incidents of an extended trial test, made about twelve years ago, in which certain results were obtained, which may be of interest to white lead manufacturers and consumers.

Being, then, in the habit of purchasing and using considerable quantities of white lead, I was desirous of having the best that could be procured; but the conflicting opinions, the vilification, and the detraction indulged in by manufacturers, painters, and other experts, so involved me in perplexity, that I resolved to make an experimental test myself. Without my purpose being known to anybody, I obtained from each of four highly reputable firms, a twenty-five pound keg of "warranted pure white lead," from each of which I took exactly one pound and placed it in a crucible of about a half pint size—a pound of lead in each of four crucibles. These I called Nos. 1, 2, 3, and 4, respectively. Nos. 1, 2, and 3 contained white lead that was made by the ordinary process then commonly in use. No. 4 was made by a new process in which a high degree of artificial heat was employed. I placed the crucibles in a bituminous coal stove, first making a strong fire, and allowing it to burn to a mass of glowing embers, in which the crucibles were embedded to prevent their upsetting; and allowed them to remain, uncovered, until heated to nearly a white heat. They were then taken out, the lead found to be melted, or supposed to be melted. When cooled they were broken to pieces to obtain the contents, which could not otherwise be removed.

Nos. 1 and 2 had nuggets of pure pig lead. No. 3 was a mass of irregular and jagged particles, matted together, and much resembling the small cinder seen under a bituminous coal fire. No. 4 was much like it.

Of course, much excitement ensued among the manufacturers when informed of the result. No. 3 was claimed to be a superior lead to any other made in this country. No. 4 maintained that the new process was every way superior to the old. As the specimens laid, side by side, exposed to view, argument seemed out of the question. The conviction of the great firm, No. 3, was overwhelming. Its character, which had been above reproach, was so seriously impaired that I was induced to carry the test still further, and for that purpose, sent the specimens to the eminent analytical chemist, Dr. A. A. Hayes, of Boston.

Meanwhile, the remainder of each keg was carefully weighed and placed in the hands of skillful painters, who kept accurate account of the quantity of oil and turpentine necessary to reduce each to the proper consistency for painting on inside old plastered walls, which were exactly alike. Nos. 3 and 4 covered much the greatest number of square yards, and made the smoothest work. Parallel streaks of each number, painted same size on smooth board, and exposed to fair light, showed No. 4 to be whitest, and No. 3 next white. Nos. 1 and 2 (the nuggets) very much the darkest.

Dr. Hayes reported, with full details in each case, that all the specimens were pure, Nos. 3 and 4, being the best manufactured, or, more thoroughly converted than Nos. 1 and 2 (the nuggets), and in my test required greater heat and difficulty to return them to their original state, than did Nos. 1 and 2.

The inference that I accordingly deduce from Mr. McArdle's communication is, that his test may—in the hands of those who are not chemists—develop a cinder like mine, that may be mistaken for an impurity, while a chemical analysis of its constituents will show it to be pure lead.

Pittsburgh, Pa. X.

### Has the Moon any Influence upon the Durability of Timber?

MESSRS. EDITORS:—In the SCIENTIFIC AMERICAN of Sept. 3, 1870, on page 148, you publish a short article under the head of "Moon Fallacies," signed D. A. M., Cincinnati, Ohio. He says: "I am quite certain if hickory timber, for instance, be cut between the full and new moon, the worms will devour it; but if cut, say three days after full moon, the worms will not touch it. Let some of your country correspondents give this matter a trial. Cut a stick of hickory, say three or four days after the full of the moon, and then cut another stick of the same kind of wood, say three or four days after the new of the moon, and set these sticks up side by side for a few months, and then let us hear the result. I venture to say, the former of these two will become worm-eaten, and the latter will show no signs of worms or wood borers."

On reading the above quotation last September, I determined to give the thing an impartial trial; as I had considerable curiosity to know the truth in the matter, having heard it discussed, *pro* and *con*, for many years. At that time, I was living at Wallingford, Conn. On September 9th, there was a full moon. September 12th I cut two hickory sticks, several inches in diameter, and four feet long. I marked these sticks with an iron band, and placed one of them in a garret, over an engine room; the other I stuck in the ground by a fence post.

New moon September 25th. On September 28th, two similar sticks were obtained from within a few feet of the first cutting, and placed each beside one of the two first specimens. Shortly after, I came to Oneida, but left the sticks in charge of a faithful man. A few days ago I wrote to this man, asking him to saw off a section of each piece, and report to me which showed the greater signs of being bored, or worm eaten. His reply is as follows:

"I have made an examination of the sticks—both of those over the engine room, and those out of doors. As for those over the engine room, they are seasoned a little, but I can discover no signs of powderpost about either of them. Those that stand out of doors are nearly as green as on the day they were cut, and show no difference. I inclose a section of the one with the iron mark."

The piece he sent me, from the stick cut in the full of the moon, shows no sign of being worm eaten.

At the end of another six months, I will again report.

Oneida, N. Y. D. E. S.

### Lunar Rainbow---Haloes.

MESSRS. EDITORS:—On page 164, current volume of the SCIENTIFIC AMERICAN, is a communication from A. O. Grube, concerning what he calls a lunar rainbow. He asks for an explanation, and if it were really a rainbow.

To this last, I answer, no. His description justifies this answer. Professor Loomis says ("Meteorology," p. 210) that the rainbow "is situated in that part of the sky which is opposite to the sun;" and, of course, with the moon it must be in the same situation. As the phenomenon he describes was a complete circle, it is certain it was not a rainbow for the above reason, and that the lower half of the rainbow is not visible unless the observer is considerably elevated above the surface of the earth.

Again, he says, "The play of the prismatic colors . . . was beautiful." Loomis says ("Meteorology," p. 211) that the colors of lunar rainbows "are faint, and generally only a white or yellowish arc is distinguishable." One more proof: the altitude of the moon was too great for a rainbow to be visible.

Now, for what it was, and the explanation. It was only a common lunar halo. The circle inside was a corona, and the belt of light immediately around the moon was such as is often seen when the sky is slightly hazy. In proof that it was a halo, I will give: 1st. It was a complete circle; 2d. It was around the moon; 3d. The clouds were right to form a halo and not right for rain; 4th. The corona, or circle between it and the moon; 5th. The light colors. Its peculiar appearance—the lower half of a circle—was caused by the clouds passing from over the moon.

I have no doubt it was a beautiful sight, but I have seen some as beautiful and remarkable. A description of one or two may not be unacceptable. On the evening of January 19, 1867, there was a double lunar halo, so bright that all the colors were quite distinct, and it lasted about three hours.

There was a solar halo August 6, 1866, which was composed of five complete circles besides the corona. It was visible for about half an hour from 11 A.M., and some of the circles were as bright as rainbows. Immediately around the sun there was the belt of light, and around this the corona; around these a double circle of 22°, crossing above and below the sun; next outside, a circle of 46°; then the parhelic circle (which was complete and distinct) passing through the sun; and last, a circle, extending from the upper part of the double circle to the opposite point in the parhelic circle. There were six parhelia, the anthelion, and the crossings of the double circle; and these, confined with the complete circles, made up one of the most beautiful sights it has ever been my lot to witness. T. MIKESELL, JR.

Wauseon, Ohio.

### Cleaning Steam Fire Engine Boiler.

MESSRS. EDITORS:—A short time ago, I asked through your paper for some method of cleaning a steam fire engine boiler. I was recommended to use five or six pounds of common soda. I will give my experience, as it may benefit others.

The boiler holds thirty gallons of water. I put in four pounds of soda, and let it remain three days. In the mean time we had two alarms of fire, but did not work. The fourth day I worked the engine, and worked nearly all the water out of the boiler through the cylinders, and drowned out the fire in the furnace. The engine was working very slowly all the time.

I have since experimented, and find the quantity that will clean and not foam, is from ¼ to ½ ounce to the gallon of water; this may vary with the quality of water used. The water I used, is from our wells, and it is impregnated with magnesia. H. CHOATE.

Shelbyville, Ky.

### Birds' Tails not for Ornament Only.

MESSRS. EDITORS:—Your correspondent, on page 194, Vol. XXIV. SCIENTIFIC AMERICAN, is sadly mistaken in his attempted explanation of the flight of birds. I would remind him that birds have tails; and that these tails act as rudders, I need not affirm. Many of your readers have, no doubt, observed that those birds which vary most in the speed of their flight, have the longest tails in proportion to their size. Now I state, without fear of successful contradiction, that if a bird, flying on a plane with the earth's surface, with tail in

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same plane, and making three strokes of wing per second should elevate his tail to an angle of 45°, he would rise above that plane; and if the tail be depressed to an angle of 45° below the plane, he would inevitably come to the ground. In regard to the stroke of the wing, I will state that if the bird stand still while the stroke is being made, it can be made perpendicular to line of flight. If the bird be moving ahead, it must be diagonal.

Nebraska, Ohio. A. K. SMITH.

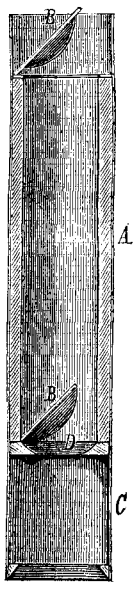
### Deep Sea Soundings and Analysis of the Waters of the Ocean.

MESSRS. EDITORS:—At a time when science is doing so much to enlighten us as to the operations of nature in domains heretofore veiled from the curious eye, and a new field is being opened, by deep sea soundings, from which we may gather materials to confirm or disprove theories built upon former scientific research, it is frequently said with regret, that no means have yet been devised to obtain water from great depths of the ocean, in a manner to preserve the gases it contains until analysis can be made; and believing that all should be willing to contribute what they can, to aid the researches thus begun, and that this difficulty can be overcome, a few suggestions are here offered, which, if they do not obviate the difficulty, may at least open the door to further inquiry, and furnish the groundwork for successful invention.

The difficulty seems to be one of force, both in the compression of water, and the dilation of gases, and the question has been how to overcome it, instead of adapting ourselves to circumstances, and seeking to evade the one, and accommodate the other.

The experiment of sinking a closed empty vessel of great strength, to be opened at the proper depth, has been tried, and it is said that on account of the great weight above, the water either crushes or filters through it before it can perform its duty; and when secured, on approaching the surface, any gases that had been subject to the enormous compression of the superincumbent water, would, on being thus relieved, dilate to such an extent as no ordinary closed vessel could be expected to resist.

This can be remedied best, not by constructing vessels of greater strength, so as to keep the gases compressed, but by providing for the gases a chamber in which they may dilate to the utmost without escaping, and thus be brought to the surface, and analyzed at leisure.




The plan is this: Use a cylindrical vessel, A C, of any size desired (see diagram), provided with two valves, B B', so adjusted that when open, they shall present the least possible resistance to the upward flow of the water, as the cylinder is sunk to the required depth; the vessel between the valves, A, to be smaller in diameter than below, and extend some distance below the lower valve, as shown at C.

The upper valve should be arranged to shut upon an air-tight rubber cushion, and be provided with a spring lock, to fasten it there when closed.

The lower valve should shut, and rest upon a movable rim, D, fitted with rubber to fill and entirely close the large portion of the vessel below, but so that it can slide without much difficulty.

The vessel can be sunk by a weight similar to that used in Brooke's deep-sea sounding apparatus, or by making the vessel heavy enough to sink rapidly by its own weight. The water would pass freely up through it until it reaches the required depth. Then, on raising it, the valves would immediately close, and, as it gradually approaches the surface, the gases must as gradually dilate, as the superincumbent pressure is removed, and, finding resistance in their upward tendency, would force down the movable lower valve, and make room for themselves as they expand.

If difficulty be experienced in closing and locking the upper valve, it can be overcome by a cord or wire attached so as to lock it at the required depth.

There could be no danger from the pressure of the water, for the vessel, being filled with water of the same density as that surrounding it, has the same pressure within as without, and the dilating gases, having room to expand, would not affect the vessel by their expansion, nor could they escape; and thus the water would reach the surface from any depth, without disturbance or loss of its component parts.

Fort Wayne, Ind. R. S. ROBERTSON.

### Domestic use of Aqua Ammonia.

A "housekeeper" in the *Michigan Farmer*, says: For washing paint, put a tablespoonful in a quart of moderately hot water, dip in a flannel cloth, and with this merely wipe over the wood-work; no scrubbing will be necessary. For taking grease spots from any fabric, use the ammonia nearly pure, and then lay white blotting-paper over the spot and iron it lightly. In washing laces, put 12 drops in warm suds. To clean silver, mix two teaspoonfuls of ammonia in a quart of hot soap suds, put in your silver and wash it, using an old nail brush or tooth brush for the purpose. For cleaning hair brushes, etc., simply shake the brushes up and down in a mixtnre of one teaspoonful of ammonia to one pint of hot water; when they are cleaned, rinse them in cold water and stand them in the wind or in a hot place to dry. For washing finger marks from looking glasses or windows, put a few drops of ammonia on a moist rag and make quick work of it. If you wish your house plants to flourish, put a few drops of the spirits in every pint of water used in watering. A teaspoonful in a basin of cold water will add much to the refreshing effects of a bath. Nothing is better than ammonia water for cleansing the hair. In every case, rinse off the ammonia with pure water. Aqua ammonia should be purchased by the pound or half pound, as druggists ask an extortionate price per ounce.

[For the Scientific American.]

### INSTRUMENTS USED IN STORM SIGNAL SERVICE.

The incalculable benefit to be derived from an efficient and active storm signal service has been thoroughly demonstrated, by practical experience, both in this country and Europe. The protection it gives to commerce and agriculture, not to mention other industries, is invaluable. Its premonition causes the mariner to seek a harbor in which his bark can weather the coming storm. The farmer watches carefully the column in his daily paper containing the reports of the signal service, and heeds the "probabilities."

To accomplish its end, the United States Signal Service uses several simple and ingenious instruments. Besides the common mercurial thermometer, the Signal Service makes use of two others, namely, the maximum and the minimum thermometer. The maximum thermometer consists of a common mercurial thermometer, stationed in a horizontal position, inside the tube of which is placed a steel index; this index is pushed forward by the mercury, as the temperature rises; but when the temperature falls, and the mercury recedes, the index remains stationary, thus registering the highest temperature. The minimum theremometer is a common thermometer in which spirit is substituted for mercury; a steel index is inserted; when the temperature falls the index is dragged with the spirit; increase of temperature and the consequent rising of the spirit does not affect the index, which still remains at the lowest point, thus registering the lowest temperature.

To measure the velocity of the wind an hemispherical cup anemometer is used. It consists of four hemispherical cups placed at the extremities of two horizontal rods which cross each other at right angles. The cups revolve with the wind, and the rods, or arms, are of such a length that five hundred revolutions is equivalent to a mile of wind. These revolutions are registered by a system of index wheels, set in motion by an endless screw on the upright which supports the rods. The force of the wind is ascertained by a tube, bent like a syphon, called a wind gage. It is one half filled with water, and its open end always faces the wind, the instrument being adjusted on a pivot. The force of the wind drives the water up the opposite leg of the instrument, which is graduated.

By putting a chemical solution in the water and pieces of prepared paper along the side of the graduated leg, it may be made to register the greatest force which the wind attains.

The rain gage consists of a copper cylinder, its upper end closed by a funnel to prevent evaporation. The rain is collected in a second vessel placed inside the cylinder, and thence measured. The relative amount of vapor in the air is measured by the hygrometer. Two mercurial thermometers are placed side by side; one, a common thermometer, is called the dry bulb thermometer, the other has its bulb covered with muslin, from which pass threads of darning cotton into a small vessel containing rain water; this is called the wet bulb thermometer. The water rising by capillary attraction keeps the bulb constantly wet. When the air is dry, evaporation from the muslin is rapid; and, on account of heat lost by evaporation, the wet bulb thermometer indicates a lower temperature than the dry one. When the air is damp, the evaporation is slower, and the difference between the two thermometers is smaller. When the air is completely saturated with moisture, the evaporation ceases entirely, and the two thermometers are equal.

Though these instruments are so simple, they are some of the most important ones in use; not the most important, however, for, to that honor, is reserved the barometer, an instrument too well known to need description here. WARREN.

### Crawling and Gathering up of Varnishes.

Says Arlot's "Manual for the Coach Painter:" A varnish has crawled, when, after being spread, its surface presents portions which have contracted. This is sometimes due to the inferior quality of the varnish, but more generally to coolness in the temperature. In winter this accident happens where there are unequal thicknesses of varnish.

Therefore, we must avoid: too thin coats in cold weather; the exposure to the air, of a body, before the varnish has had time to become somewhat hard; the direct action of the sun.

A slight crawling may be remedied by an increase of heat, in the drying room for instance. But when the defect has disappeared, we must avoid any chilling by cold, because there would be no further remedy. Therefore, the proper temperature must be kept up till the varnish is hard. It is then polished, and after further hardening, it must receive a fixing coat, and be rubbed and varnished for the last time.

If it be not possible to remedy the crawling by the above process, the defective parts must be removed with a knife, washed with a rag without lint, and varnished again with a small brush. When these parts are dry, they are smoothed with a pumice stone, and rubbed with a rag and pumice-dust before striping.

In the case of a general crawling, there is no other remedy but to wash off all the varnish with turpentine and a linen rag, providing the varnish has not hardened too much. Then, allow the panels to dry, and polish.

But when the varnish has set so that it cannot be dissolved, let it dry, then scrape it, pumice, and paint again.

Of all the accidents which may happen to the coach painter, crawling is the most troublesome.

### Jarrah Timber.

There are on view at Melbourne, Australia, three logs of Jarrah timber, sent there by the government with a view of exhibiting the capabilities of this remarkable wood. A Melbourne paper states: the logs are about twenty feet in length with a diameter of about twelve inches, and, having been sawn down the full length and polished, exhibit the splendid grain of the wood to great advantage. Any person glancing at these piles would never believe that for more than a quarter of a century they had been submitted to the continued action of salt and fresh water, in which the dreaded *teredo navalis* abounded, as there is not the slightest sign of any deterioration having taken place. The wood is as firm and solid as when first hewn. The grain is close, of a fine dark color and taking a rich polish. There can be no doubt that these piles have been in use as long as stated, as each pile bears a written certificate from an officer of the Western Australian Government to that effect. They were driven in the year 1840 and taken up in 1870, having been thirty years in use, subject to the influence of wet and dry, air between wind and water, in salt water and fresh. They are polished on one side to show the small effects of thirty years' wear and tear. The point has not been altered in any way, but is as it was driven in 1840. The head is also in its original state, it having been used as a fender pile. It is stated that not only does this timber withstand the attacks of the *teredo navalis*, but it is also impervious to white ants. In Western Australia, if deal be used for building purposes, it is totally destroyed within twelve months by the white ants which abound, and consequently jarrah is principally used for building purposes and is found to answer admirably. The valuable properties of this wood are attributed to its containing a powerful astringent gum, which acts as an insect poison; and in order that this might be fully ascertained, a chemical analysis was supplied to the Western Australia Timber Co. by the Hon. F. P. Barlee, Chief Secretary of that colony. It was as follows: "In accordance with instructions received, I have made a qualitative analysis of sundry specimens of the jarrah, with a view of obtaining, from its chemical composition, actual proof of the existence of the principle which renders the timber impervious to the action of dry rot, and proof against the attacks of the *teredo navalis* and the white ant. I find that the duramen contains from 16 to 20 per cent of an astringent gum, sparingly soluble in alcohol, but completely so in boiling distilled water. Upon further analysis, this gum was found to consist almost entirely of coloring matter and a highly astringent vegetable acid, which may be termed jarrah tannic acid, inasmuch as it possesses some of the characteristics of tannic acid, together with other reactions peculiar to itself. I have failed to discover an alkaloid or organic base (although several different processes have been adopted), since, after the separation of the gum albumen, and coloring matter, I obtain nothing more than traces of saccharose and glucose, with fatty matter, which in the present inquiry are of little or no importance. It is therefore evident that the active principle of the jarrah is the powerfully astringent acid, which, uncombined with any base, is suspended in the gum, and thereby uniformly diffused throughout the tissues of the wood, in a thin section of which innumerable translucent particles of the gum may be seen by the aid of a small convex lens."

### Manufacture of French Nails.

French nails, says the *Mechanics' Magazine*, are manufactured at Charleville, partly in large factories by machinery, partly in a multitude of small factories, or rather *atéliers* scattered about the densely-peopled villages. These villages, and especially one of them, Neufmanil, are not only inhabited by people, but by an *ouvrier* class of dogs. The labor of these dogs, whose hours are as exactly regulated as those of their human fellow laborers, consists in furnishing motive power to the bellows, which fan the furnaces of the *atéliers*. They get inside a wheel, and turn it, just like squirrels in a cage.

There are four stages of each day's labor. The first lasts from 5 to 8 A.M.; the second, from 8:30 to 12 P.M.; the third, from 1 to 4 P.M.; the fourth, from 4:30 to 7 P.M. Each dog works during two stages only. The early dog, who works from 5 to 8 A.M., misses the second stage, and is not employed again till 1 P.M. The dog who begins his day's work at 8:30 misses the third stage, being reserved for the fourth.

Another peculiar feature of the nailmaking industry is, that each workman or woman belonging to a particular *atélier* has to furnish a fixed and equal daily supply of fuel to keep the furnace going, which is consumed, whether the individual contributor works or not on any particular day. As the workpeople are paid by the quantity of nails each produces, the burning of their fuel, whether they work or not, acts as a strong stimulant to continuous labor.

WONDERS OF THE HEAVENS.—There may be seen at present, soon after sunset, the planets Jupiter, Mars, and Venus and the Moon, all careering magnificently in their orbits, Mars in the east, Venus in the west, and Jupiter about in his zenith, with the moon rising toward her meridian. They all seem nearly in a direct line in the heavens, and are, when unclouded, remarkably brilliant, affording a rare and beautiful sight, such as we are not often favored with. This attractive display may be observed for several evenings to come. Saturn does not rise until toward morning, and Mercury rarely appears to the naked eye.

THE drying of grapes, for making raisins, is becoming a large industry in California, the highly saccharated juice of the American grapes peculiarly fitting them for the purpose.

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### Improved Self-centering Saw Arbor.

The saw arbor, illustrated in our engraving, has a self centering device which, we think, will commend itself to mechanics, as a neat, durable, and exceedingly convenient attachment, calculated to obviate the trouble, time, and expense of centering saws by bushing in the old method; and, being entirely confined to the loose collar which holds the saw, capable of universal application without change of arbors.

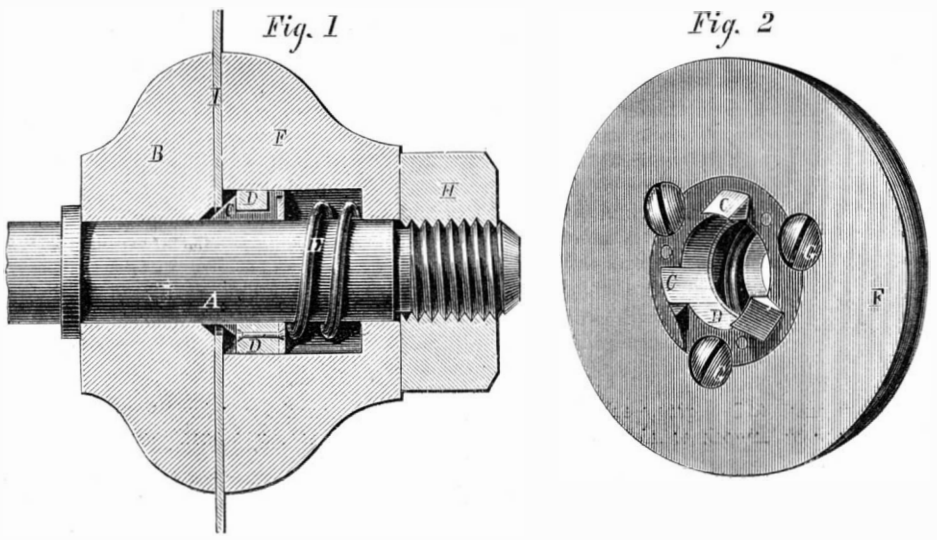
Figs. 1 and 2 are, respectively, a perspective view and a section, showing the form and application of the improvement.

The arbor, A, is turned off at the end, to form a shoulder against which the back of the inside half, B, of the collar rests, as indicated in the engraving. The outer half of the collar is formed hollow, and in its interior is arranged a series of steel points, C, supported in a movable inside collar or ring, D, from which their ends project, the ends being beveled off as shown in the engraving. A thin steel washer is riveted to the back side of the ring, D, to support the points in position, and still to allow them to spring slightly inward with any pressure upon their outer beveled ends, so that they will press closely down upon the arbor, A, when in use.

A coiled spring, E, is arranged within the opening at the rear of the ring, D, which presses the ring out even with the face of the collar, F; while guide screws, G, are set at the side of the opening, on which the ring can slide back and forth, and by means of which it is retained within the opening, and also prevented from turning round. The saw is arranged upon the arbor between the two halves of the collar. The bevel points enter the eye of the saw should the eye be of greater diameter than the arbor, and the saw will be properly centered and supported by the bevel points.

As the nut, H, is screwed on, the two parts of the collar clamp and hold the screw, I, in the usual manner. The points and ring recede into the opening, so that the former project only just far enough to retain the saw at its proper center.

Patented, Dec. 6, 1870, by James B. Heald, of Milford, N.H., whom address for further information.




HEALD'S SELF-CENTERING SAW ARBOR.

### Improved Flower and Tree Tub.

This is a very neat device, and one which obviates several difficulties which florists experience in the management of wooden tubs. Among these may be mentioned the dropping of hoops, the decay of the upper ends of the staves, and the difficulty of removing a large plant without too great disturbance of its roots.

The construction of this tub will be readily understood by reference to Figs. 1 and 2—Fig. 2 being a section showing the method of holding the parts of the tub together.

These parts are the bottom, the staves, the top rim, the bottom rim, and vertical rods, with nuts which hold the whole structure firmly bound together.

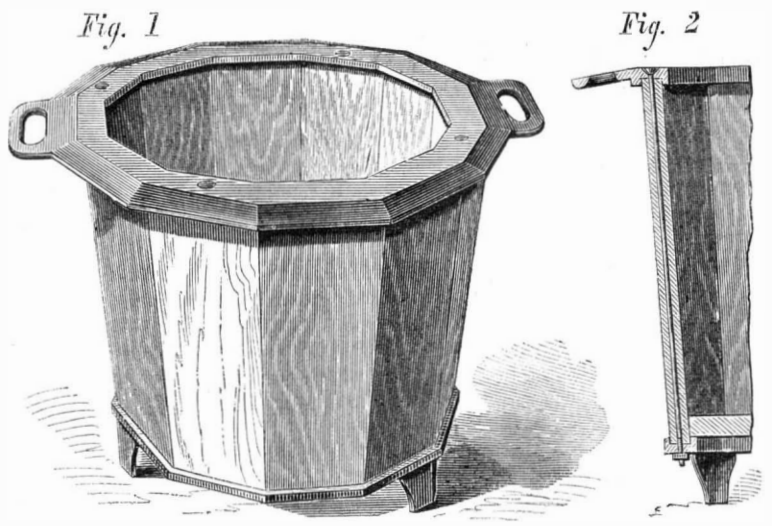
The bottom plate or rim is of galvanic or tinned cast iron, and provided with legs, as shown. Upon its upper surface is cast a groove, into which the lower ends of the staves fit. Within the staves, the bottom plate presents a ledge upon which a perforated wooden bottom rests when in use.

The upper rim is also made of galvanized or tinned iron, and has, cast upon its under side, a rim suited to receive the upper ends of the staves, the whole being held together by vertical rods and nuts under the bottom plate, as shown in Fig. 2. The upper plate is also provided with convenient handles cast upon it, as shown.

The bottom, being movable, can be raised when it is desired to take out a plant, raising with it the ball of earth, without breaking it.

The upper ends of the staves are measurably protected from the action of weather by the iron rim, and their decay is thus retarded. The top and bottom rims being supplied, any ordinary carpenter can furnish the staves, or replaces such as may give out before the others.

Patented, March 12, 1867, by Jesse Booher. For rights to manufacture and sell on royalty, for territorial rights, or for further information, address Hoglen & Houck, 28 Wyandotte street, Dayton, Ohio.




BOOHER'S FLOWER POT AND TREE TUB.

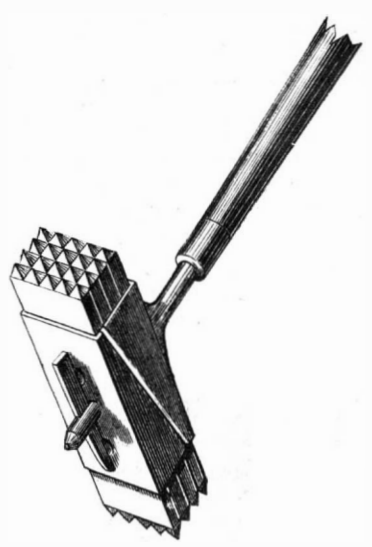
### Imagination in Science.

Professor Tyndall will eventually have much to answer for. He has lent his authority to the admission of imagination in the pursuit of science, and there is every prospect that people whose imaginative faculty is stronger than their habit of observation, will give us all plenty to do. We shall not only have to question nature, but we shall have to eliminate imagination, and thus have two battles to fight for truth. Our medical friends have not always walked in the ways of rigid observation and induction, but if any one desires to see how easy it is for the imaginative faculty alone to tell us all we require to know, we commend to his perusal a communication in the *Mobile Daily Register*, from Dr. Cochrane, on the subject of yellow fever, well written and interesting, and giving what may be called an account of yellow fever from the imaginative side. The author justifies his position by the example of European names; tells us candidly that he states only "what he believes but does not know," and then takes his flight into the unknown. He imagines "the yellow fever poison to be composed of living germs in innumerable number, living organisms of inconceivable minuteness, which eat, and drink, and multiply their generations under the sun, just as other living creatures do with which we happen to be familiar." He connects his speculations in these matters with similar speculations about "contagia" and disease "germs," which are well known on this side of the Atlantic, and without paying any attention to facts regarding yellow fever, and other diseases which are left untouched by any extant doctrine, he tells us truly that "the visions of modern science are more wonderful than the visions of Eastern fable." This may be true, and the visions themselves may be true; but, for people who feel that they must walk over the earth in search of truth, nutriment of this kind is by no means sufficient for mental sustenance.

We have no desire to undervalue the importance of the imaginative faculty in scientific pursuits; but papers such as the one before us raise some very important primary questions. Are we to live, scientifically, in the same way as alchemists and astrologers did in the middle ages? and are we to ignore all that Bacon and Newton have done for us? If it be true that there is no royal road to knowledge on the firm earth, it is certain there is no such road through the air. Let us use the imaginative faculty, by all means; but, in doing so, let us take our stand on the firm ground of the known before we venture ourselves into the unknown.—*Nature.*

### FURROWING HAMMER FOR STONE DRESSING.

This tool consists of a handle and two clamps, brought forcibly together by a key driven into a slot, cut through the



end of the handle, which projects through the clamp. The handle passes through four four-pointed chisels, as shown, the holes being formed in the centers of the chisels, so as to bring their points into a common plane. The use of the tool is apparent from its construction. It is the invention of Lewis Sauers, of Mount Joy, Pa.

### Facts about Copper.

Prof. Dembrinsky contributes to the *Mechanics' Magazine*, the following facts about copper:

Copper is malleable, flexible, and ductile, though inferior in these respects to silver. It is of specific gravity 7.780 to 8.534.

A wire of 1-10in. will support a weight of 299½ lb. It melts at 27 deg. Wedgewood.

Exposed to fire it becomes bluish, yellow, and at last violet. When in contact with coals, it gives a greenish blue tinge to the flame, and if kept long in fusion, a part is volatilised. Heated in contact with air, it burns at its surface and becomes changed into an imperfect blackish red oxide, which by a more violent heat is converted into a brown glass or more perfect oxide.

If melted and cooled slowly, it forms in quadrilateral pyramids. It has no action on water, yields oxygen to many of the other metals, but takes it from mercury and silver. It combines readily with sulphur, forming a very fusible mass termed sulphuret of copper; it also readily unites with phosphorus, forming a gray, brilliant phosphoret of copper.

It is acted on by sulphuric acid only when concentrated and very hot, when it is oxidised by it, and affords blue crystals, being the sulphate of copper, blue vitriol, Cyprian vitriol, or blue copper, which is largely used for medical purposes and by metal workers.

It is attacked by diluted nitric acid with effervescence, abundance of nitrous gas being emitted; and a blue solution is thus obtained, yielding crystals of nitrate of copper of a grass green color.

Ammonia does not dissolve the oxide of this muriate with the same facility as that of other cupreous salts.

When acted on by the acetic acid, it is corroded, and yields the substance known as verdigris. Being combined with oxygen it becomes more readily soluble in vinegar. The oxide of copper dissolved in vinegar forms the acetate of copper, distilled verdigris, or crystals of Venus. The blue solution of copper indicates the less, and the green the greater degree of oxygenation.

The fixed alkalies and even many neutral salts act on it, and, it is said, act most powerfully in the cold and when it is exposed to the atmosphere. It is also readily acted on by rancid fats and oils, forming powerful poisons. It is precipitated, from the solutions, in its metallic form by a clean plate of iron, the iron, covered by copper, being known by the name of copper of cementation.

With the earths it unites only by vitrification. It mixes with most of the metals, forming with arsenic or zinc, the white tombac; with bismuth, an alloy of a reddish white color with cubic facets; with zinc, by fusion, brass; with a solution of quicksilver, it acquires a white surface. On the precipitation of the quicksilver, it easily unites with tin, and on this depends the art of tinning. Fused with tin it forms bronze or bell metal; alloyed with silver it is rendered more fusible.

When copper is added to gold, the gold is hardened and its color heightened.

Copper precipitates silver from the solution in nitric acid. This method is used to separate the silver after the operation of parting.

Copper filings being added to caustic spirit of ammonia, no solution takes place except air be admitted; and if this be admitted only for a short time, and though the solution takes place, it remains colorless, but if air be admitted, it becomes a color varying from blue to the deepest red.

Animal substances contain it, and it exists in the vegetable kingdom, even in vegetables supported merely by air and moisture.

If, to the solution of copper filings, fresh filings be added before it has been too long exposed, it will lose its color and only regain it by admission of air. Copper is used and applied for various domestic uses, medical purposes, and generally in the arts.

### Value of Scientific Knowledge to the Clergy.

The Rev. William F. Morgan, D.D., Rector of St. Thomas Church, Fifth avenue, in this city, one of the very largest churches in New York, in a recent letter renewing his subscription to the SCIENTIFIC AMERICAN, pays the following graceful tribute to the value of science to the clerical profession:

"In my opinion the best investment that any clergyman could make would be to subscribe for the SCIENTIFIC AMERICAN, and gather from its ample pages, the actual advancement of mind, and the development of the inventive faculty, and the amazing combinations of power, skill, adaptation, and practical usefulness, which almost any recent discovery, or even improvement, would disclose. Except in the Bible, the doctrine of man's immortality is nowhere better taught than in those imperishable institutions and careful, beneficent studies, which result in honor to the man and good to the race."

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## PISCICULTURE IN NEW YORK AND NEW JERSEY.

It has long been seen by naturalists that the propagation and cultivation of fish is as much within the limits of possibility as poultry or pork growing. It has, however, taken much experience, and long study of the habits of the various kinds of fish desirable for human food, to bring the art of pisciculture to a point where it may be said to be uniformly successful, as the growing of pigs or chickens. If this point be not already reached, it evidently will be ere long. Already the advances made are very great, and every year adds to the general stock of knowledge upon this important subject.

It seems odd to speak of domestic cod fish or tame pikes, yet these things are realities, and, if we are to believe statements made by those who ought to know, the quality of the cod is greatly improved by selecting his diet for him instead of leaving him to the full gratification of his natural tastes.

The oyster has long been systematically raised, and it is a well known practice, in some parts of the country, to fatten these delicious bivalves with Indian corn meal, sprinkled upon heaps of them in a cool cellar. We do not believe the story told us by an Eastern knight of the quill, about a tame clam that has been taught to stand on its head, and to count any number up to fourteen at word of command; but we see no reason to discredit the statement that codfish may be rendered so tame, that they may be picked out of the water by hand when wanted for the table. We have seen fish in ponds so tame that they would take food from the hand, and might have been seized, if it had been desired to do so.

Fish are not only wholesome but very cheap food, and those now engaged in preserving the fish in our waters, from wanton waste, and stocking our rivers with valuable food varieties, are doing a public service, which, in a few years, will result in immense benefit to rich and poor alike.

We are led to these observations by a glance through the reports of the Commissioners of Fisheries of the States of New York and of New Jersey. In both these States, the most reckless prodigality in fishing formerly prevailed. Fish were taken in the spawning season, and their eggs thrown away to fertilize land. Large and small fish were indiscriminately seized, in season and out of season. Dams were built across streams, for private benefit, without regard to obstructing the passage of fish ascending to upper waters to deposit their spawn.

The Commissioners are changing this state of affairs, and inaugurating a new and more provident system. Their labors have been severe in combatting old prejudices and obstinate resistance on the part of ignorant fishermen, who could at first see in the action of the Commissioners only an arbitrary encroachment upon their rights, instead of a wise protection of the natural store upon which their business depends.

We think no one can read the reports alluded to, without being convinced that the two commissions named are doing a great public service.

Of all the edible fishes which ascend from the sea into our fresh-water streams, the shad is the most valuable, and, perhaps, as yet, the greatest mystery to naturalists. Whatever unknown substances constitute his bill of fare, they are certainly of a kind to impart to his flesh a flavor gratefully acceptable to the human palate. It would seem strange that the principal food of this fish has never yet been determined. Rarely one rises to the fly of the fisherman, or seizes upon the minnow, designed to entrap some other member of the finny tribe, but this is evidently when, for want of his favorite diet, the keen demands of appetite have driven him to extremity.

Much speculation and study have as yet thrown but little light upon the food of the shad. The report of the New Jersey commissioners states that "stomachs of shad captured in the Delaware river, one hundred miles from the sea, are frequently found filled with a green slimy mass, which is proved, by microscopic examination, to be composed of half digested fragments of the *ulva latissima*, a well known marine aquatic plant, common on our coasts. In one examined by the commissioners, May 16, 1870, at Howell's Fisheries, located at Fancy Hill, six miles below Philadelphia, the entire stomach was filled with a soft, pultaceous, salmon-colored, unknown substance."

Whatever it is, their food evidently exists in large quantities. The prolific character of the shad is also noteworthy. There is no doubt whatever that the annual catch may be doubled or quadrupled, in all our Atlantic streams, by efforts such as the Commissioners are now making. The character of these efforts has been heretofore explained at length in this journal, and hence need not be dwelt upon here. Their importance will, however, be better appreciated when we state, on the authority of the Commissioners, that the price of shad has risen from six to sixteen dollars per hundred in the lower waters of the Delaware river, and to thirty-five dollars in the upper portion. Similar advances in price have been made in shad caught in the Hudson. These advances are chiefly attributable to the reduction of the supply, though of course, partly to increased demand.

The system of gilling seines is notoriously destructive and obstructive, and the Commissioners are laboring to correct its abuses, in which labor they should have the countenance and support of all good citizens.

## IRON RAILS FOR COMMON ROADWAYS.

There exists a growing belief that iron rails might be advantageously applied to country roads, making tramways whereon heavy loads could be drawn by horses, at all seasons of the year. The condition of the majority of American roads in rural districts during the spring and fall rains, and subsequent to the fall rains, before the snow fills up the ruts, is almost indescribably bad. At their best, these roads exact very much from teams and vehicles, but at the seasons mentioned, they are in many cases wholly impassable to loaded wagons; and nearly all of them are in such a state as to render traveling upon them most disagreeable and tedious.

If it can be demonstrated that iron ways will wholly remedy, or greatly mitigate, this evil, such roads would doubtless meet great favor, as substitutes for the now discarded plank roads, provided their cost could be brought within due limits.

Mr. J. R. Garretsee contributes to the American *Rural Home* (Rochester, N. Y.), an article in which some statistics, bearing upon this subject, are given. In the article referred to it is stated, on the authority of a committee of the Farmers Club, that the cost of hauling produce to market, in the county of Monroe, N. Y., is $150,000 per annum more than it ought to be, were the roads such as they should be. This extra cost would, according to the report of the committee, construct over forty miles of macadamized road each year, at a cost of $3,500 per mile, or one hundred miles of gravel road.

Mr. Garretsee has made a computation relative to the marketing of the produce in a single town (Parma), in Monroe Co. This town has a road running through its center, from Lake Ontario, on the north, to the Erie Canal and New York Central Railroad on the south, with a gradual rise of 160 feet in the entire distance. Cross roads connect with it, and the road is considered as a fair average sample of earth roads throughout the country. "This road," says Mr. Garretsee, "is, when needed most, simply—*awful.*"

Over this road are transported, annually, twenty thousand tuns of produce, at a cost of $30,000, estimated on the low basis of $1·50 per tun. This is considered to be at least double what the same transportation would cost on a good macadam road.

But Mr. Garretsee goes further, and advocates an iron road, as cheaper and better, and more easily kept in repair than any other road of equal efficiency. The road proposed should, he thinks, take the center of the highway, and should resemble in its main features the tramways now used by city horse-railroad companies, except that the rails should be made a trifle lighter, and about one inch wider. The track between the rails should be of broken stone covered with gravel, the whole to be one foot in depth. The estimate made of the cost of such a road is $7,000 per mile.

The article closes with an extract from a letter written by a correspondent of this journal, demanding the invention of a rail suitable for such roads. Mr. Garretsee will find, also, an editorial article calling attention to the improvement of country roads, by this means, on page 169, Vol. XIX., of the SCIENTIFIC AMERICAN.

While we concur in the opinion that iron rails, of some kind yet to be devised, properly laid, would make an excellent road for farmers' use, it is evident to us that many of the advocates of the system do not appreciate all the difficulties in making such roads. These difficulties are none of them insurmountable, yet they should be thoroughly considered. To omit their consideration will be to insure failures, in the first attempt at the introduction of such a road system, which we hope will be avoided.

It is true that on country roads the bulk of freight is carried in a single direction, but to neglect provision for loads in the opposite direction, would be excusable only after careful consideration of the subject had demonstrated the disadvantages of such a provision to be greater than the advantages. Turn-outs, at reasonable distances, or other contrivances, calculated to subserve this end without the cost of double track all the way, will doubtless be forthcoming when inventors see there is a demand for them.

Again, country roads are much more affected by frost than the more thoroughly drained city roads, and are also liable to become covered with ice and frozen mud—a difficulty experienced on city tramways in winter, and one which often entails large expense and trouble. Concave rails, which have been suggested by some, would be particularly liable to fill and clog. Convex rails require grooved or flanged wheels, not to be thought of for ordinary vehicles; and the flat rail, with vertical flange at the outside, is probably the best form tnat could be employed.

The preparation of the road bed is also a work which must not be underrated. This should be done to such a depth, and with such materials, as to secure permanency, Thoroughness at the outset will save much cost and trouble in subsequent repairs.

If roads of this kind be properly constructed, they would, in our opinion, prove useful and economical in thoroughfares subjected to considerable travel. At any rate, we should be glad to see the experiment tried in some enterprising locality, and we hope Mr. Garretsee, will succeed in his attempts in Monroe Co. In this matter, as in others, actual experience is better than all theorizing, as establishing the value or worthlessness of a system.

## FIRING OF STEAM BOILERS.

Of the firing under steam boilers, much has been said and written in works upon steam engineering, and plain, practical directions for the proper performance of this work have, in various forms and connections, been given in this journal. This is one of the things, however, upon which a paper like the SCIENTIFIC AMERICAN, which aims to instruct all classes of mechanics and workmen, must perforce repeat its precepts. Every year brings forth a new crop of boiler tenders who have to be instructed in regard to their duties from some source. Many of them are ignorant as horses, of the laws of combustion, or the laws of steam; and bad firing must be said to be the rule rather than good firing, so far as this country is concerned. Judging also from complaints on this score in English journals, that nation of steam users is not much better off than ourselves. We shall endeavor to make our remarks on this subject as practical as possible, only referring to theory when necessary to give point to practical directions.

Passing by the kindling of the fire, which requires no particular skill, the regulation of the thickness of the stratum of fuel on the grate, and the supply of fuel to the furnace, next claims attention. The additions of fuel should be made to that portion which lies at the front of the grate, especially when draft holes, at back of the grate, are not used. The fuel thus placed on the front of the grate becomes coked, as it were, before being spread over the grate. In the coking process, the products, first driven off from the coal by the effects of heat, which would otherwise pass out of the chimney as waste fuel, commonly called smoke, will get a supply of air from the apertures in the furnace door sufficient to nearly, or quite, consume them.

When the fuel is of such a character that coking cannot be done in the manner described, it should be spread evenly all over the grate, and maintained at as uniform a thickness as possible. We are believers in pretty thick firing, and would hardly recommend a thickness of less than eight inches in moderately large grates, unless under exceptional circumstances; and in no case should fuel be carried more than a foot in thickness in the furnace of any land boiler.

The next thing is the adjustment of the dampers to supply the proper amount of air to the fuel, and here is where most inexpert boiler tenders fail lamentably. Every pound of air allowed to enter the furnace more than is practically found necessary to consume the fuel at the required rate of consumption carries off with it heat, which should be applied to making steam. But while boiler tenders are to blame in this matter, it must be confessed that the construction of some furnaces is such as to render the proper regulation of air admission a thing of much difficulty. Grates are often too long in proportion to their width, and in this case, when air is admitted only at the front, more air than would be necessary on a short grate is required in order to keep the combustion perfect at the rear of the furnace. The loss of heat from the improper regulation of the draft is often enormous. The dampers in front should be kept as nearly closed as possible, consistently with the maintenance of a clear uniform bright fire on all parts of the grate.

Another great fault in firing arises frequently in the use of a boiler too small to generate the steam required with economy. The boiler tender finds that he cannot keep the steam up to the required pressure without forcing the firing beyond the point of highest economy, and, we may also add, the limit of safety, for there is no doubt that the forcing of boilers beyond their capacity is a fruitful cause of explosions. When firing is forced, the gases of combustion pass with excessive rapidity through the uptake, and do not so nearly impart their full measure of heat to the surfaces over which they pass. This can be easily proved by examining their temperature with a thermometer inserted in the uptake. It will be found that the more the firing is forced beyond a certain point, the greater will be the volume, and the higher will be the temperature, of the gaseous products escaping in a given time.

Loss of heat is sustained in slicing the fire, etc., and this loss is lessened in proportion to the rapidity with which the

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operation is performed. It is of the utmost importance that the flow of air through the grate should be free as possible, and, therefore, the slicing should be done thoroughly, but as quickly as practicable. This is a point, however, which is more generally complied with than the more important ones above insisted upon.

A difference of twenty-five per cent in economy between good and bad firing might undoubtedly be often discovered; and, we believe, that with the greater proportion of large-sized boilers used in this country, the wages of skillful firemen might be doubled or trebled with profit, rather than substitute for such men those who are either ignorant of their duties or unfaithful.

## ARTIFICIAL STONE.

The future material for houses and engineering structures in this country is evidently artificial stone. The wages of stone cutters and the high price of labor generally must determine this question. It may be well, therefore, to consider some of the inventions, that have been made within the last few years, looking to a solution of the important problem. Artificial stone can now be made in Europe of undoubted strength and durability, and cheaper and better than hewn stone. We understand that in this country satisfactory experiments have been made, and there is every probability of a general acceptance of this material as soon as the public are made aware of all the facts of the case.

We do not propose to enter into a history of all of the mortars, cements, concretes, and the like, that have been made since the time of the Romans, but to speak of some of the modern experiments that have attracted the most attention from engineers. Perhaps the best known cement or artificial stone is the *Béton-Coignet*. We have had occasion to witness the preparation of this celebrated building material in Paris, and have examined some of the constructions in that city and elsewhere, and can therefore speak from personal observation. *Béton* was introduced into France about thirteen years ago, by M. Coignet. There was much opposition to it at first, and it was only cautiously tried on constructions of little importance.

This caution was well founded, as the first mixture was unsatisfactory, because it was made of coal cinder with lime, and was not found to work well. By progressive experiments and changes of constituents, M. Coignet finally hit upon a mixture that was able to resist all extremes of weather, and to withstand the severest tests that could be applied to it. It is of this invention that we propose to speak. *Béton-Coignet* is a mixture of a large proportion of sand with a small percentage of lime, to which is added a little cement, the quantity of the latter varying with the amount of hardness or the rapidity of setting required; it may be said to be an artificial stone, formed of sand, lime, and water, capable of being used in blocks or in continuous masses, for foundations, walls above and below ground, sewers, water pipes, floors, pillars, arches, embankments, aqueducts, reservoirs, cisterns, and the entire walls of buildings, bridges, tunnels, flagging, and, in fact, all structures ordinarily made of brick or stone. It is a mortar in which only a very small quantity of water is employed to moisten the lime and sand, and in which the materials are ground in a mill to a stiff paste, and compacted into forms by heavy blows of a peculiarly constructed mallet. As we witnessed the operation in Paris, it did not appear any more difficult than ordinary mortar making, only that there was more machinery used in the *béton*.

On the average, 1·31 bushels of the mixture of sand, lime, and cement, make a cubic foot of *béton*, which will weigh about 140 pounds, and offer a resistance of 2½ tuns per square inch; while ordinary mortar, formed of the same constituents, will exhibit very insignificant powers of resistance. It will be seen that the weight of a cubic foot is less than that of ordinary building stone, while its resistance to pressure is greater. In mortar, a large quantity of water is employed, and this, on drying, leaves a porous mass, which possesses very slight resisting power. The cost of *béton* in Paris, two years ago, was from $5 to $8 per cubic yard. We have in former numbers of this journal given some account of the manner in which artificial stone is made, but the revival of interest in the subject will warrant us in refreshing the knowledge of our readers on the subject. Great care should be taken in selecting the ingredients. The lime should be hydraulic, in fine powder, well screened to preserve it from lumps; and river sand should be used when feasible. The grinding mill employed in France is not unlike the one used in porcelain manufactures. It consists of an iron cistern, the bottom of which is perforated, and in the center of which revolves a vertical shaft, armed with knives, and a board, which in each revolution discharges a part of the paste. There is a penstock covering the outlet, to regulate the discharge of the *béton*. The ingredients are measured into the mixing mill in barrows, and during this process, small quantities of water are gradually added. Very much depends upon the care bestowed upon this part of the work, as it is essential that every particle should be moistened, in order that the setting may be more rapid and the stone become harder. As good or bad bread can be obtained from the same flour, according as the kneading is well or imperfectly done, so a hard or a crumbling cement can be made by entirely or partially moistening and mixing the ingredients. The plastic material from the mill is thrown into a mold in thin layers, and each layer, as it is laid on, is beaten and compressed by the regular and even blows of a sixteen pound hammer. The successive layers are cross cut, as in plastering, in order to insure their firm adhesion. The form of the mold must depend upon the proposed use of the stone. In buildings it may consist of close boarding, kept in place by cross bracing, and may be made to carry complicated ornaments, cornices, and tracings, that would be very expensive if they were to be wrought out of solid stone. Fine specimens of statuary have been made of the well mixed material. The arches of the basement to the Paris Exhibition of 1867, which constituted a perfect labyrinth, and were of great extent, were formed of five parts sand, one of lime, and one fourth cement. In no other way could these vast constructions have been completed in time for the exhibition. They were visited by thousands of persons interested in the subject, and did more to dispel doubts and satisfy engineers than any previous works constructed of this material. The work was done with amazing rapidity, as the centering was often struck within ten hours after the *béton* was got in place, and the passages were ready for service in four or five days after their completion. The embankment at the Trocadero in Paris, for a quarter of a mile, is supported by a wall of *béton* forty feet high, and one of the bridges over the Seine is built entirely of the same material. In Egypt, the very sands which threatened to destroy the Suez Canal have been appropriated to the manufacture of sea walls, embankments, lighthouses, and vast constructions, by this system of Coignet.

In view of all these facts, it is not surprising that so much attention should be bestowed upon artificial stone in this country. It cannot be long before we shall discover a cement equal to the best Portland, and the ingenuity of our inventors will soon supply improved machinery for working up the ingredients. In the construction of the sewers, boulevards, and heavy embankments of the upper part of the island of New York, it is worth while to consider whether the artificial stone is not the best material that could be employed. In the far West, where stone is scarce, there can hardly be a doubt as to the value of *béton* for building purposes. We have chiefly confined our remarks to the *béton*, because that is most familiar to us, but we do not intend to disparage other inventions, which are making their way to popular favor, and appear to be worthy of all that has been said in their praise. The subject of artificial stone is well worthy the attention of our engineers.

## SUGGESTIONS FOR THE IMPROVEMENT OF RAILWAYS.

As usual after the occurrence of any severe railway accident, the recent disaster on the Hudson River Railway has showered upon us a large number of suggestions relative to the improvement of railways and their management, so as to obviate such disasters in the future. A great many of these suggestions emanate from men who have no practical knowledge of railroading, and so little theoretical knowledge as to render their suggestions of no value.

There are others, however, worth consideration. A Boston correspondent, referring to the numerous accidents which have lately occurred in depots, by passengers stepping into or off from cars in motion, thinks railroad companies are morally, responsible, if not legally so, for accidents of this kind, since such accidents, resulting from carelessness or imprudence of passengers, might be prevented by a change in the construction and arrangement of platforms in the depots.

He points out the fact that the platforms are now placed so as to leave a space of about two feet between them and the cars. Persons walking along the edge of these platforms are liable to slip and fall off under the cars, and be injured, and are sometimes crowded off in the rush for seats in trains.

He suggests that a uniform height for platforms in depots should be adopted, at least on the same road, and that perforated shield plates be attached to both sides of cars, extending laterally so as to reach over and a little beyond the edges of the platforms, and joining the steps of the cars in a proper manner. Also, that shield plates be placed between connected cars, to prevent passengers from falling between them; and that, also, a bridge with side railings should be placed between connected cars.

He further suggests that cars should always be coupled and uncoupled from above, instead of from the side as is usually the case, and thinks the details of these improvements will offer little difficulty to engineering skill, and entail very little additional cost upon railway companies.

## THE BATTLE OF THE TIRES.

The question of rubber tires for traction engines is one now hotly disputed on the other side of the Atlantic. This is about how the matter now stands.

First, the advocates of the soft rubber tires claim that the experiments performed at Rochester, described in one of our late issues, were made in the interest of Aveling and Porter, and that they were not fair, as the proper proportions of the tires were not observed, as they are on the Thompson road steamer. Further, it is claimed, as proof that the manufacturers of the rigid tired wheels are really convinced of the value of the rubber tires, that Messrs. Aveling and Porter have purchased a license to use such tires from Mr. Thompson, the patentee. The first of these statements is replied to by a denial; and the second is answered by a statement of Messrs. Aveling and Porter that they do not avail themselves of their license to use rubber tires, because they are not yet convinced of their durability and efficiency.

A correspondent of the *Engineer*, writing from Glasgow, over the signature of "Old Traction Engine Driver," asks a series of questions, which, by implication, may be fairly translated into statements in regard to rubber tires, as follows:—A 6-foot Thompson's tire weighs 6 cwt., and costs 2*s*. a pound, or thereabouts. The tires of the Thomson engine, with their armor, cost £209—that is, about $1,050 in gold. He further states, by implication, that the rubber tires, when left to rest in a damp and warm atmosphere, spontaneously evolve the sulphur they contain, and decay, and that the use of the armor reduces the tractile power of the wheels, while to omit the armor insures the speedy destruction of the rubber tires. He adds that, in his opinion, Mr. Thomson's tire possesses certain advantages over ordinary iron tires, which, under most circumstances, are not worth the first cost of the rubber, even if the rubber could be got to last, say for three years, and under no circumstances are worth the first cost, seeing that the performance of the costly tires cannot be depended on for even a few months. He thinks that, in about a year, the present purchasers of Thomson's tires will be less pleased with them than they are now. The replacement of a new set of tires will be found a rather costly item in repairs.

We give these statements for what they are worth. They are not made in that spirit of candor which appeals to the inborn sense of truth; and yet they certainly represent an existing doubt whether the rubber tires do not cost more than they repay in practice.

There are so few of these engines in use in this country that we must rely, for the present at least, upon the facts received from foreign sources, in making up our judgment. The correspondent referred to assumes to speak from the card, and yet we feel that it would not be safe to found a judgment upon the statements he makes.

*Per contra*, we find a letter in *The Engineer*, in which the writer gives his experience as entirely favorable to the durability of the rubber tires, both with and without armor. He has found the breakages to be confined chiefly to shoe-plates and rivet links. He has worked the tire continuously from Sept. 20th to the date of his letter (March), without material reduction in its thickness through wear, and he ascribes the trouble hitherto met with in the use of these tires to the fact that, their proper consistency not being fully ascertained, some blunders were necessarily made in this particular. The tires described by this correspondent have, he says, drawn a load of from 13 to 14 tuns, gross; 260 journeys of 7 miles each (1,820 miles, up a gradient of 1 in 10, most of the way), with a consumption of coal averaging 700 lbs. per day, from 5 A. M. to 2:30 P. M. The external surfaces of the tires are, he states, only slightly marked, while the surface next the rim of the wheel is as smooth as when first put on.

The *Irish Farmers' Gazette*, of March 18th, contains an extract from the *Scotsman*, describing a very successful experiment with a Thompson road steamer made in Dunmore Park, on the estate of the Earl of Dunmore—this gentleman having invented an improvement on the shoes heretofore employed to prevent their slipping on wet grass. Lord Dunmore's invention consists in an addition of "clams" to the shoes surrounding the india-rubber tires, converting them, as it were, when the steamer is used in plowing, into hob-nailed shoes.

The journal quoted, says:—"The field to be broken up had lain in pasture for 40 years, and had not been plowed since 1831. It was therefore extremely tough to work, and the ordeal was great both to the road steamer and the plow. It had also rained heavily all the morning and all the previous night and day; and as the field had never been drained, it afforded ample opportunity for the verification of the evil prophecies of those who had declared that no traction engine could drag itself, much less a plow, over such land. The engine, however, steamed down the field in the easiest and smoothest manner imaginable, and its work was admirable. The furrows, 6 inches by 10, were beautifully turned over, closely packed, giving a nice shoulder and a capital seed bed. Notwithstanding all the adverse circumstances, there was not a hitch but what would have occurred to an ordinary swing or double-furrow plow. Horses brought into the field in the morning sunk into the soil three inches."

The rapidity with which the work was performed, and the number of furrows simultaneously turned, are items not mentioned in the extract alluded to, so we can form no opinion upon the results of the experiments in these particulars.

The old proverb, "that there are two sides to every story," is singularly illustrated in this controversy. Time will be the arbiter of this, as of other questions of importance. The evidence is not all in yet.

## EMPLOYMENT OF FEMALES IN NEW YORK.

The labor of women is largely employed in this city, the constant immigration keeping the market overstocked, and preventing anything like a rise in wages. Of 24,000 hands, distributed among the trades of bonnet-frame making, paper-box making, bookbinding, paper-collar making, shoe fitting, cap making, hotel and restaurant attending, artificial flower making, hair weaving, and lace sewing, we find that the earnings generally average about seven dollars per week, for work of ten hours per day. Putting such peculiar and limited trades as satchel sewing and type setting out of consideration, it must be admitted that the average wages paid to women are small, and that employers get full value for their money. A good shoe-fitter will earn $20 or $22 a week; a lace sewer almost as much; while the run of wages to women compositors is about 20 per cent below men's. A great many females are employed in tobacco stripping—work so simple that mere children can do it, and the pay is from $3 to $5 per week. The wages of paper-collar makers are no higher, and this large trade employs 4,000 hands in the city of New York.

The *Star*, to which we are indebted for some of the above figures, states that "no girl, who values her health, should work at folding and stitching."

The condition of many of these working girls is one of extreme hardship. Many are constantly out of employment, and when employed, their wages scarcely suffice to supply

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them with food, clothing, and lodging, even of the plainest kind. The benevolent and philanthropic are, however, endeavoring to ameliorate their condition, and it is to be hoped that a better day is dawning for women and girls obliged to support themselves by the labor of their hands.

## SCIENTIFIC INTELLIGENCE.

### FIVE MILLIARDS OF FRANCS.

The indemnity to be paid to Germany by France is said to be five milliards of francs, and as this sum exceeds the ordinary transactions of life so greatly as to be unintelligible, a German scholar has founded some calculations upon it for the edification of his countrymen. We give it for what it is worth. The weight of five milliards of francs, in gold twenty franc pieces, is 3,548,380 pounds, and it would require a train of 322 average freight cars to transport it. The same sum in silver five franc pieces would weigh 55,000,000 pounds. A practised teller can count out 40,000 francs an hour in five franc pieces; assuming that he were to begin his counting at 25 years of age, and to work steadily eight hours for 300 days in the year, he would not complete his task until he had passed his 77th birthday. If laid down in one franc pieces, so as to touch each other, the line would extend 71,461 miles, nearly one third of the distance from the earth to the moon. In gold twenty franc pieces, the line would be 3,262 miles long. Finally, if we call to mind that since the birth of Christ not one milliard of minutes has passed away, we can understand that, if for every minute, day and night, since the commencement of the Christian era, a five franc piece had been laid aside, we should not yet have extinguished the debt of France."

### MANGANESE IN VEGETABLES.

It has generally been stated that manganese does not occur in vegetables, but recent researches go to show the error of this assertion. In examining beech wood which was grown on soil containing manganese, near the University of Göttingen, also near Geissen, too much manganese was found to be considered accidental. Finally, beech nuts from the famous park of Blenheim, in England, have been shown to contain manganese as a regular, fixed constituent. From these observations, it would appear that this metal is a constituent of a certain species of tree, and it is probable that it will be found in other varieties, if search be made for it. The question is interesting, from an agricultural point of view, and may lead to ingenious experiments.

### EXAMINATION OF PHARMACEUTISTS.

We have been shown the examination papers of the recent graduates of the College of Pharmacy, in New York, and must say that we find the questions thorough and searching. Any student who could answer all of these questions must be regarded as fully entitled to a diploma from the trustees, and the compounding of medicines may be safely intrusted to his charge. We give below some of the questions, for our readers to try their hands at answering, selected at random from a long printed list:

What is glycerin, and how is it prepared?

How much iodine is required to prepare 2 drachms of iodide of iron?

What are the different kinds of fermentation and their products?

What is the best antidote in poisoning by arsenic, and how is it prepared extemporaneously?

Digitalis: Definition, natural order, habitat, medical properties, officinal preparation, doses.

Opium: Definition, natural order, commercial sorts, alkaloids, tests, symptoms of poisoning, antidotes, incompatibles, medical properties, names and strength of official preparations, and their doses.

What is the officinal name for calomel? preparation? common impurity? how detected?

What is the characteristic difference between decoctions and infusions?

What is pyroxylin? how prepared? properties and uses?

What are the equivalents of the kilogramme and gramme in grains, and what are the equivalents of the liter and cubic centimeter in grammes?

### GAS FROM THE RESIDUUM OF PETROLEUM.

What to do with the heavy tar left in the retorts after the naphtha, kerosene, and other products have been distilled off, has occupied oil dealers ever since the introduction of petroleum as a burning fluid. A number of patents have been taken out, covering various uses, but the most valuable is probably the conversion of the residuum into illuminating gas. This is a vey simple and neat operation. It is only necessary to heat the oil in a suitable retort, pass it through a scrubber, and thence directly to a gas holder. As it has already been distilled at a high temperature, the lighter and more inflammable oils have been removed; and there is no sulphur or ammonia requiring expensive purifiers. The whole operation can be conducted as readily as the distillation of resin, and affords a gas so rich that ordinary burners cannot be used; but in their places, tips, consuming only one foot per hour are substituted. Gas from coal requires a five feet burner to produce the same illuminating effect as can be obtained from one foot of the gas from petroleum. A number of towns, large factories, schools, and private dwellings are lighted with this gas, and as the explosive mixtures are previously removed in the original refining of the crude petroleum, there is not the same danger as we have pointed out in the case of naphtha, gasoline, and air light. Where a sufficient supply of this residuum of stills can be had, it ought to afford a pure and cheap light.

### A New Water Meter.

One of the most comprehensive and interesting papers on mechanical subjects which we have met with, is that of Mr. Fred. E. Bodkin, on "Water Meters," read before the Society of Arts, in London, Feb. 12th. It shows very thorough knowledge of the various principles employed in Europe to solve the very knotty problem of measuring, under pressure, the flow of water through pipes. In this paper the uses of water meters are succinctly set forth, and then the leading principles of construction of all the principal meters is described, their deficiencies and defects explained. The merits of a new invention in this line are emphatically extolled by Mr. Bodkin, who says:

A great step in the removal of the defects, both in this and every other meter yet introduced, is exemplified in an invention by Messrs. Cook and Watson, a meter which has only lately come before the public notice. It consists of an upper plate, indented on the under side with a ring of thumb holes, and riding loosely in a chamber over a lower plate, through which inclined inlet holes are bored. The water rises through these holes, raises the upper disc, and, acting against the square ends of the thumb holes, causes it to rotate at the same time. This action, of course, requires some small power to commence, but as soon as the upper plate is lifted it must also necessarily rotate. When the supply ceases the upper plate falls, and forms a tight valve against the return of the water; and since, during its period of revolution, this plate floats in a film of incoming water, there are no wearing surfaces involved in the machine. Small stays are placed on the upper surface of the revolving plate, in order to produce regularity of motion under varying pressures, and appear, from the specimens I have at different times been enabled to test, to do so with complete success.

These machines are not expensive, and offer but small opposition to the flow of liquid, and certainly appear to be the simplest and most practicable form of high-pressure meter yet invented.

### The Chronopher.

"Greenwich time" is kept all over England and Scotland by all the railway, postoffice, church, and watchmakers' clocks. The time is sent daily, at 10 o'clock, from Greenwich Observatory, all traffic over telegraph wires used for the purpose being suspended at 9·58. Sixteen of the most important cities are in direct communication with Greenwich, and places through which the wires pass are aware of the completion of the circuit which announces 10·0 o'clock. The principal London watch and chronometer makers, such as Dent, Vulliamy, Barraud, Walker, Frodsham, and others, are communicated with even more frequently. Guns are fired at the ports of Newcastle and Shields at one o'clock daily by the same means. The clock at Greenwich, which automatically sends the time, is called a chronopher, and is corrected to a variation of a twentieth part of a second in a week.

This is an useful arrangement in England, where the country is so small that one uniform time can be kept without varying more than a few minutes from solar time, even in the most distant cities. But it could not be practiced in the United States. No assimilation over a part of the country would do anything but confuse and perplex the public; and if the clocks of San Francisco kept New York time, they would vary from solar time, by a difference of more than three hours.

### A State Reward for Inventions.

The Legislature of New York has now before it a bill to encourage the invention or discovery of new and better methods of propelling canal boats. The bill offers *fifty thousand dollars reward* for the best plan, and has passed to its third reading in the Assembly. During the discussion, one of the most experienced and intelligent members spoke of the importance of this proposition to inventors. He knew the $50,000 would be a mere bagatelle to the real value of such an invention, but he was frank to say that he did not believe the State would soon be called upon to pay that $50,000. Such an invention would be worth millions of dollars, and whoever could produce what was wanted, ought to be paid $1,000,000, instead of $50,000.

Another member announced his willingness to vote for the bill, but at the same time, from what he had seen in the days of his youth, when passenger packets were on the canals, he did not believe the speed looked for could be secured without washing the banks of the canals.

We believe that some of our ingenious readers are competent to study out the solution of this problem, and we advise them to try. Unless an attempt is made, nothing will be accomplished. One of the good effects of the offering of specific rewards for special inventions is that careful study is induced, which leads to useful results, in some direction or other. Many unexpected and useful discoveries have thus been made.

### Cutting Glass by the Blowpipe Flame.

At a recent meeting of the Albany Institute, a member exhibited specimens of glass cutting by the use of the blowpipe, which is specially adapted to cutting tubes of all sizes, thick or thin. A sample of a tube cut spirally in this manner has been sent us. The tube is about 1¼ inches in diameter, and is cut from end to end in a spiral, the cuttings not averaging more than ¼ inch in distance from each other. The cutting is done by directing the point of the blue flame against the side of the tube. Instantly, a small check or crack is formed, which may then be led in any direction by directing the point of flame to the part to be cut. In dividing thick and large tubes, it is advised to begin by separating them into large sections, and afterward subdividing these sections, till the required length is reached.

### The Lenox Library.

The munificence of private citizens of the United States in their gifts for public purposes has often brought forth expressions of astonishment and admiration from European and other travelers who have paid us visits; and certainly the liberality of the donors, and their more rare and good judgment are matters of which we have right, as a nation, to be proud. Mr. James Lenox, a very worthy and wealthy citizen of New York, purchased a block of ground fronting on Fifth avenue, between Seventy-first and Seventy-second streets, and facing the Central Park; and arrangements have been consummated, and plans drawn, for the immediate erection of a library building, massive and solid in construction, and of grand and imposing proportions. Lockport limestone will be the material used, and the building will be fire-proof. The ground and building will cost, in all, about $1,000,000, and the work will be commenced at once.

TENNESSEE INDUSTRIAL EXPOSITION.—A grand industrial exposition of the mechanical, mineral, and manufactured productions and arts of Tennessee will be held at Nashville, May 8 to 27, 1871. Circulars containing rules and instructions, with full information, may be obtained by addressing Tennessee Industrial Exposition, Nashville, Tenn.

THE importance of cotton seed for oil manufacture is appreciated in England, the annual production of oil having reached 20,000 tuns.

### Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

APPLICATIONS FOR LETTERS PATENT.

671.—HANDCUFF AND SHACKLE.—J. J. Tower, Brooklyn, N. Y. March 14, 1871.

675.—PRINTING MACHINE.—C. T. Bainbridge and R. P. Yorkston, New York city. March 14, 1871.

688.—REFINING AND PURIFYING CAST IRON.—James Henderson, New York city. March 15, 1871.

689.—PRINTER'S COPYING INK.—C. McIlvaine, Wm. McLloyd, and F. J. Firth, Philadelphia, Pa. March 15, 1871.

699.—FORMING ELBOWS AND BENDS IN METAL PIPE.—Charles Hoeller, Cincinnati, Ohio. March 16, 1871.

704.—COUPLINGS FOR HOSE AND OTHER PIPES.—P. Barnes, Jr., Troy, N. Y., now residing at 8 Southampton Buildings, in the county of Middlesex, Eng. March 16, 1871.

727.—DRIVING MECHANISM FOR SEWING MACHINE.—A. W. Harris, Providence, R. I. March 17, 1871.

737.—MACHINE FOR SPINNING, WINDING, AND DOUBLING FIBROUS MATERIAL.—George Draper and W. F. Draper, Hopedale, Mass. March 18, 1871.

740.—MANUFACTURE OF TEXTILE FABRICS.—George Merrill, New York city. March 18, 1871.

747.—NAIL-CUTTING MACHINE.—Oscar Mussman, New York city. March 20, 1871.

749.—FASTENING AND SUSPENDING WINDOW SASH.—P. W. Gates, Chicago, Ill. March 20, 1871.

755.—BREECH-LOADING FIREARM.—W. C. Dodge and P. T. Dodge, Washington, D. C. March 20, 1871.

### Foreign Patents.

The population of Great Britain, is 31,000,000; of France, 37,000,000 Belgium, 5,000,000; Austria, 36,000,000; Prussia, 40,000,000; and Russia, 70,000,000. Patents may be secured by American citizens in all of these countries. Now is the time, while business is dull at home, to take advantage of these immense foreign fields. Mechanical improvements of all kinds are always in demand in Europe. There will never be a better time than the present to take patents abroad. We have reliable business connections with the principal capitals of Europe. A large share of all the patents secured in foreign countries by Americans are obtained through our Agency. Address MUNN & Co., 37 Park Row, New York. Circulars, with full information on foreign patents, furnished free.

## Queries.

[*We present herewith a series of inquiries embracing a variety of topics of greater or less general interest. The questions are simple, it is true, but we prefer to elicit practical answers from our readers, and hope to be able to make this column of inquiries and answers a popular and useful feature of the paper.*]

1.—TURNING CURVED PLUNGER.—Will Mr. Patten tell us how he would finish the plunger, where the flange plate is attached to it?—S. G. S.

2.—ELECTRIC CURRENTS.—If, as is claimed by some, electricity does not consist of two currents in opposite directions, how is it that a card punctured by the passage of a discharge from a Leyden jar is equally burned upon both sides?—F. I.

3.—CEMENT FOR LEAKS IN GAS HOLDERS.—I wish a good cement for the above purpose. I have tried many recipes, but the oil from the gas either softens everything I have used, or the cements crack, when hard, from the working of the holder.—F.C.

4.—DIAMETER AND PITCH OF TOOTHED WHEELS.—Will some one give me a short and accurate way of determining the diameter of cog wheels, pitch and number of teeth being given; and, *vice versa*, to get the pitch, the diameter and number of teeth being given? I have the tables of given numbers, but these I do not happen to have with me at times—probably when most wanted. I know the rule: Set off 7 times the pitch on a straight line; divide same length into 11; each division equals 4 teeth on the radius; but this is incorrect in small wheels or pinions. Is there not some short and accurate rule that a man may think of at any moment, without tables, etc?—J. W.

5.—SHELLAC POLISHING.—How ought I to prepare shellac for polishing on a wheel?—J. L.

6.—ANNEALING STEEL.—What is the best way to anneal cast steel for filing or drilling, so as to remove the little "pins" appearing usually in steel, which a file will hardly touch?—F. A. K.

7.—PLASTER MOLDS.—What can I add to plaster of Paris, when mixing it for molds, that will enable it to withstand the action of water at 312° Fah?—G. M.

8.—POLISH FOR WOOD IN THE LATHE.—I wish a recipe for a transparent polish to be applied to wood, while in the lathe, after it is turned, and which requires a nice finish.—W. H. B.

9.—CASE-HARDENING IRON.—Will some expert in processes of this kind favor me with instructions how to harden iron in the various ways found valuable?—E. B. T.

10.—WHITE GLUE.—How is white glue made? Full details of the process are requested.—J. F. H.

11.—WANTED.—By that large class who are under the sad necessity of using crutches, some device to protect the clothing, around the arm, from the wear and tear consequent upon their friction.—CONSTANT READER.

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## Business and Personal.

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SCIENTIFIC AMERICAN—If you want back Nos. and Vols. of the SCIENTIFIC AMERICAN, at low prices, address Theo. Tusch, 37 Park Row, N.Y.

American Boiler Powder Co., P. O. Box 315, Pittsburgh, Pa.

The Universal Clothes Washer is warranted to wash clothes as well as any other washing machine. Price only $2.50. Address J. K. Dugdale, Whitewater, Wayne Co., Ind.

Only $1,500 for a Patent of a Valuable Tool. Can be cast, or will be sold in State Rights. J. F. Ronan, Station A, Boston, Mass.

A. G. Bissell & Co., East Saginaw, Mich., manufacture Packing Boxes in shooks.

Wanted.—A first-class Draftsman and Calculator. One acquainted with drafting iron hulls, etc. None other need apply. Address, AT ONCE, with best references, W. S. Nelson, No. 618 N. Main st., St. Louis, Mo.

Parties manufacturing machines adapted to boring small cylinders, are requested to send illustrated circulars to J. E., Drawer 116, Bridgeport, Conn.

Wanted.—A situation as Analytical Chemist. Good references furnished. Address "Chemist," P. O. Box 60, Haverhill, Mass.

Commercial Travelers, Carpenters, Hardware Dealers, and others, address for sample of the best Sash Lock and Catch yet made Charleton & Woodbury, New Britain, Conn., or Madison, Wis. Contains no spring, and but one movable piece. Can be applied to any window in five minutes.

Wishing to increase my business, I desire to make arrangements with some responsible Sewing Machine Manufacturers, to furnish them with needles. All work warranted. Address E. S. Hill, S. Abington, Mass.

Bok & Bennett are dealers in Patents, and introducers of patented articles, 258 Broadway, New York.

Models in Miniature.—Wanted, working models of Steam Engines, Agricultural Implements, or any machine directly applied to agricultural purposes. Inventors and Patentees will please address circulars to Senor de Moncada, Grand Hotel, Broadway and 31st st., New York.

Manufacturers of Corn, Cotton, and Seed Planters (everywhere) send address and circular to Levi Scofield, Watertown, Wis.

Newton's Principia.—Wanted, a copy of this work. Address Publisher SCIENTIFIC AMERICAN, 37 Park Row, stating price.

Mechanical Draftsman wanted.—One experienced and expert in getting up machinery will find permanent employment, with liberal weekly pay. Address E. H. Stearns, Erie, Pa.

To Club Agents.—Those who have raised Clubs for the SCIENTIFIC AMERICAN, and others, can make it pay to take a Local Agency for the publications of S. R. Wells, 389 Broadway, New York. They are popular, practical and useful. Inclose stamp for terms.

A person with a knowledge of Chemistry, and 30 years' experience in Electro Plating (with some practice in Nickel Plating), is open to an engagement on reasonable terms. Address "Chemist," New Haven, Ct.

Superintendent Wanted.—An energetic man, capable of superintending a factory. Must have a general knowledge of mechanics. One familiar with the manufacture of horn, shell, or vulcanite preferred. The very best reference required. Address "Horn," P. O. Box 2874, New York.

Machinery for the manufacturing of all of kinds of Rubber Goods, made by W. E. Kelly, New Brunswick, N. J.

See advertisement of L. & J. W. Feuchtwanger, Chemists, N.Y.

Carpenters wanted—$10 per day—to sell the Burglar Proof Sash Lock. Address G. S. Lacey, 27 Park Row, New York.

Manufacturers' and Patentees' Agencies, for the sale of manufactured goods on the Pacific coast, wanted by Nathan Joseph & Co., 619 Washington street, San Francisco, who are already acting for several firms in the United States and Europe, to whom they can give references.

Pattern Letters for Machinists, Molders, and Inventors, to letter patterns of castings, all sizes. Address H. W. Knight, Seneca Falls, N.Y.

Improved mode of Graining Wood, pat. July 5, '70, by J. J. Callow, Cleveland, O. See illustrated S. A., Dec. 17, '70. Send stamp for circular.

All parties wanting a water wheel will learn something of interest by addressing P. H. Wait, Sandy Hill, N. Y., for a free circular of his Hudson River Champion Turbine.

Self-testing Steam Gage. There's a difference between a chronometer watch and a "bull's eye." Same difference between a self-tester and common steam gage. Send for Circular. E. H. Ashcroft, Boston, Mass.

Belting that is Belting.—Always send for the Best Philadelphia Oak-Tanned, to C. W. Arny, Manufacturer, 301 Cherry st., Phil'a.

E. Howard & Co., Boston, make the best Stem-winding Watch in the country. Ask for it at all the dealers. Office 15 Maiden Lane, N.Y.

For mining, wrecking, pumping, drainage, and irrigating machinery, see advertisement of Andrews' Patents in another column.

Millstone Dressing Diamond Machine—Simple, effective, durable. For description of the above see Scientific American, Nov. 27th, 1869. Also, Glazier's Diamonds. John Dickinson, 64 Nassau st., N. Y.

Walrus Leather, for Polishing Steel and Plated Ware, at reduced rates. Greene, Tweed & Co., 10 Park Place.

Oak-Tanned Leather Belting.—We make an extra quality, cheapest for the consumer. Greene, Tweed & Co., 10 Park Place.

Gage Lathes for Broom and other handles, Chair Rounds, etc. Price $20. With attachment for Null work, price $30. Also, Wood-turning Lathes. A. L. Henderer & Co., Binghamton, N.Y.

E. P. Peacock, Manufacturer of Cutting Dies, Press Work. Patent Articles in Metals, etc. 55 Franklin st., Chicago.

Peck's Patent Drop Press. Milo Peck & Co., New Haven, Ct.

Dr. E. F. Garvin's Tar Remedies cure Gout and Rheumatism. Sold by Druggists.

Inventors' Coöperative M'f'g Co, 258 Broad'y. Send for circular.

H. S. Redgrave, Norfolk, Va., would like information as to the most improved process or apparatus for drying fruits, either by steam, hot air, or other means.

Wanted, a man, fully up to the times, who has acted as Superintendent of a Gun or Sewing Machine Factory, to take charge of a shop. One fully competent to set up the machinery and break in the help. Address H. H., 35 Bond st., N. Y.

Brown's Coalyard Quarry & Contractors' Apparatus for hoisting and conveying material by iron cable. W. D. Andrews & Bro, 414 Water st., N.Y.

Improved Foot Lathes. Many a reader of this paper has one of them. Selling n all parts of the country, Canada, Europe, etc. Catalogue free. N. H. Baldwin, Laconia, N. H.

Cold Rolled-Shafting, piston rods, pump rods, Collins pat. double compression couplings, manufactured by Jones & Laughlins, Pittsburgh, Pa.

Keuffel & Esser 116 Fulton st., N.Y., the best place to get 1st-class Drawing Materials, Swiss instruments, and Rubber Triangles and Curves.

For Solid Wrought-iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

The Merriman Bolt Cutter—the best made. Send for circulars. H. B. Brown & Co., 25 Whitney ave., New Haven, Conn.

Taft's Portable Hot Air, Vapor and Shower Bathing Apparatus. Address Portable Bath Co., Sag Harbor, N.Y. (Send for Circular.)

Glynn's Anti-Incrustator for Steam Boilers—The only reliable preventive. No foaming, and does not attack metals of boilers. Price 25 cents per lb. C. D. Fredricks, 587 Broadway, New York.

For Fruit-Can Tools, Presses, Dies for all Metals, apply to Bliss & Williams, successor to May & Bliss, 118, 120, and 122 Plymouth st., Brooklyn, N.Y. Send for catalogue.

Presses, Dies, and Tinners' Tools. Conor & Mays, late Mays & Bliss, 4 to 8 Water st., opposite Fulton Ferry, Brooklyn, N.Y.

2d hand Worthington, Woodward and Novelty Pumps, Engines 25 to 100 H.P., 60 Horse Loc. Boiler. W. D. Andrews & Bro., 414 Water st., N.Y.

English and American Cotton Machinery and Yarns, Beam Warps and Machine Tools. Thos. Pray, Jr., 57 Weybosset st., Providence, R.I

Winans' Boiler Bowder.—15 years' practical use proves this a cheap, efficient, safe prevention of Incrustations. 11 Wall st., New York.

To Ascertain where there will be a demand for new machinery or manufacturers' supplies read Boston Commercial Bulletin's Manufacturing News of the United States. Terms $4 00 a year

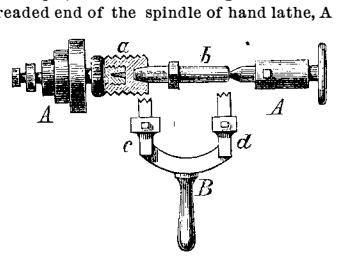
## Answers to Correspondents.

*CORRESPONDENTS who expect to receive answers to their letters must, in all cases, sign their names. We have a right to know those who seek information from us: besides, as sometimes happens, we may prefer to address correspondents by mail.*

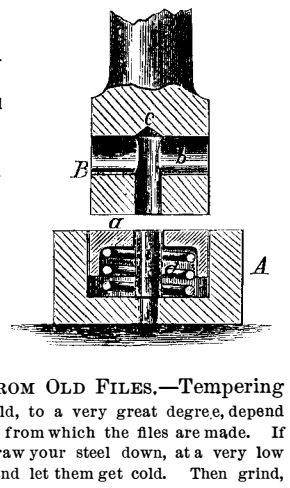
*SPECIAL NOTE.—This column is designed for the general interest and instruction of our readers, not for gratuitous replies to questions of a purely business or personal nature. We will publish such inquiries, however, when paid for as advertisements at 1·00 a line, under the head of "Business and Personal."*

*All reference to back numbers must be by volume and page.*

CUTTING SMALL BRASS SCREWS.—L. C. D. asks for a plan to cut small brass screws, fine thread and true, in a quick and reliable way. I submit drawing of tool that is simple, and that will do good work if given half a chance. On the threaded end of the spindle of hand lathe, A A, a hub, *a*, is screwed; said hub is threaded on its outer surface, the same pitch being given as is required on the bolts to be cut. The hub has a square, tapered socket formed in its free end, for the retention and driving of the bolt, *b*; the bolts to be turned and chased should have one end squared to fit the socket in *a*. The chaser holder, B, is constructed, as shown, with two boxes, one of which carries the guiding chaser, the other the cutting chaser. The guiding chaser, *c*, meshes into the hub, *a*; the cutting chaser, *d*, cuts the bolt, *b*. A proper rest, or support, for the holder should be provided. The great difficulty which amateurs experience, in using a chaser, is to properly start the thread. This tool overcomes the trouble, and, with a little practice, by its use a true thread can be cut without failure.—W. P. P., of Pa.




CUTTING BLANKS FOR TOOTHED WHEELS.—In the SCIENTIFIC AMERICAN of March 25, B. B. S. desires a plan to cut blanks of small toothed wheels and to punch the center hole at one operation. I send a drawing of a method, now in use for similar work, that operates well. The lower die, A, cuts the outside of blank; the small punch, *i*, is rigidly adjusted in the center of die, A. A flanged disk, *a*, is provided of proper size to slide in die, A, and over punch, *i*. A stout spiral spring, preferably of steel, supports the disk, *a*, level with the upper face of the die, A. The upper punch, B, has a longitudinal hole of the size of punch, *i*, drilled in its center; a transverse hole or opening, *b*, is cut to intersect hole, *c*, and should be of sufficient size to permit the waste cut by punch, *i*, to pass out. The spring, *d*, should be of sufficient strength to remove the punched blank from die, A, by forcing up disk, *a*.—W. P. P., of Pa.




TEMPERING CHISELS MADE FROM OLD FILES.—Tempering cold chisels made from old files, would, to a very great degree, depend upon the quality and temper of steel from which the files are made. If the chisels are made from saw files, draw your steel down, at a very low heat, to the shape or form required, and let them get cold. Then grind, or rub with sandstone, at least two inches up from the cutting edge, till bright, which enables you to see distinctly the change in color as it advances to the end. Heat them slowly, at least three inches from the point upwards, in a clean, low fire, till you get a cherry red heat through the body of the metal. Effectually cool them in clean cold water, one inch up from the point. Rub away the dirt from the surface with your sandstone, and the heat above will bring down your white, cool end, gradually and bodily, to a dark blue; cool off, and you have a good tool. If your files be small flats or rounds, run down your temper, by the same process, to a pale blue, and cool off. If your files be large, cool off at a dark straw color. These remarks apply only to files made from good material and on most approved principles. Should the nature of your steel by the foregoing process, require a higher or a lower temper, regulate it by the degrees of color in your tempering, but in no case make your steel too hot. But you may rest satisfied that if your files have been bad as files, they will not make good cold chisels. Want of precaution, ignorance of the nature of steel, and overheating and hurry in the hardening and tempering tools, have wasted thousands of dollars that would otherwise have been moving in the legitimate channels of commerce and trade. If you want a good tool, there must be no undue haste in making it; your steel should never be heated in a quick hot fire, from the fact that the point is hot before you have sufficient heat above to gradually bring down the temper. Besides, in this way, you do not get even the point heated as a mass. A hot, quick fire gives you a skim heat, and, if you adopt this process, do not charge the fault to the steel, but to your individual ignorance, carelessness, or undue haste, when your tools crumble off in bits at the points, and you have to spend more time at the grindstone than at the lathe or vise. All files for cold chisels should be annealed, though this is not necessary for lathe tools.—B. C., of Pa.

CUTTING FINE THREADED SCREWS.—L. C. D., does not give the length of the screws, nor state whether it is necessary that they should be cut sharp up under the head. If they are not to be so cut, a solid die, having three or four cutting edges in it, may be made to do the work by flaring out the three or four first threads, so that it will act like a female taper tap. If necessary to come sharp up under the head, use a second die that is not tapered out. Make the outside of the dies round, and on one side slot them right through to the center; then put them into a holder, having a set screw in it, and set them together, by means of the set screw, if they make the screw too large. Use them in the engine lathe with the screw gearing on, if necessary.—S. G. S., of Conn.

BOILER FURNACE.—N. H., with two boilers, will find that a furnace constructed as follows will answer his purpose: Fire the full width of both boilers with 7 feet grate bars, then let each boiler have its own draft of 2 feet 6 inches by 15 inches deep, a division wall running from the fire back to the end flue. Distance from back wall to boiler, 2 feet—or 3 feet would be better. Use good fire brick for walls.—G. D., of Miss.

J. G., of Miss.—We have no means of judging as to the durability of the cement you name. We certainly should not condemn it upon present information, and we should not praise it over others, even if we knew it to be superior. The proprietors of a good article need no gratuitous advertising from us.

YELLOW RAIN.—The yellow powder, observed by H. H. B., after the storm of March 8, 1871, at New Orleans, was the pollen from the blossoms of the forest trees of the Great Mississippi Valley.

J. L. & Son, of Md.—With the same mean effective pressure, and same amount of radiation, the indicated power of two engines will be in proportion to the steam consumed. A cylinder 7 x 9, making 300 strokes per minute, will, with equal mean effective pressure, give two and one fifth times as much power as a cylinder 5 x 10, making 240 strokes per minute.

W. A., of R. I.—The suggestions made in the article sent us on improved permanent way for railways, contain nothing substantially new. Stone supports for rails have been tried, but have not met with favor. Such a permanent way as you describe would cost more money than railway companies are willing to pay, and would, we think, be accompanied by practical difficulties unforeseen by you.

T. B. K., of Pa.—An inch rope laid upon a level surface, and long enough, so that its friction in moving would be greater than the tensile strength of the rope, would of course break before tension could be transmitted from one end to the other.

W. P., of Md.—Lightning conductors conduct only on their surfaces. A hollow tube slit longitudinally will conduct both on outside and inside surfaces, or if open at both ends will conduct on both sides. The resistances of conductors vary as their cross sections.

N. T. D.—We should prefer Bunsen's carbon battery to Daniell's for the voltaic arc experiment. Forty eight of Bunsen's elements have produced good results. We should not expect much success with fifty Daniell's elements.

H. B., of Pa.—We do not think tea is liable to become tainted with lead from the lead lining of the chests, unless, through leakage water should gain access to the contents.

## Recent American and Foreign Patents.

*Under this heading we shall publish weekly notes of some of the more prominent home and foreign patents.*

DUMPING CART.—William Hand, Plainfield, N. J.—This invention relates to a new and useful improvement in dumping carts, whereby much time and labor is saved, and it consists in attaching the body of the cart to the axle and in connecting the "hind board" of the cart body with the shafts, attaching the shafts to the body, and in fastening the body of the cart down to the shafts by a hook which fastens automatically.

CONSTRUCTING WATER-PROOF CELLARS, CISTERNS, ETC.—Tobias New, Brooklyn, N. Y.—This invention relates to a new and useful improvement in the construction of water-proof cellars, cisterns, vaults, and all underground apartments for whatever purpose, whereby the bottom and walls of such cellars, etc., are made perfectly impervious to water.

ADJUSTABLE SEAT.—Louis Postaroka, East Cambridge, Mass.—This invention relates to a new and useful improvement in seats for pianos and other purposes, and consists in making the seat adjustable as to hight.

SWIVEL PIN FOR TETHERING ANIMALS.—William Lyon Troop, Camp I, Halleck, Nevada.—This invention relates to a new and useful improvement in a pin for tethering horses and other animals.

COMBINED WASHER AND WRINGER.—Cyrus E. Carter, Martinsville, Ohio.—This invention relates to new and useful improvements in machines for washing and wringing clothes, whereby convenience, ease of action, and expedition are secured.

AUTOMATIC CLOSING GATE.—Benoni F. Palmer, Baraboo, Wis.—This invention relates to a new and useful improvement in mode of hanging and operating gates, whereby the gate is made self-closing, and may be opened from either side or in four different directions.

COMB.—Leonce Picot, Hudson City, N. J.—This invention has for its object to avoid the corrosion of the metal strengthening backs applied to horn, bone, and composition combs, to permit warping, which is caused by the acids deposited on the combs in use, and it consists, in one case, in applying the stiffening ribs so as to be wholly covered by the substance of which the comb is made, and in another case, in providing a raised rib between the metal back and the base of the teeth, one on each side, to arrest the said deposit in advance of the metal backs, and prevent contact therewith.

PREPARING SILK AND OTHER TEXTILE FABRICS FOR PRINTING.—Louis Prang, Boston, Mass.—This invention has for its object to facilitate the proper printing of silks, laces, and other textile fabrics of a pliable character, in one or more colors.

ELECTRICAL GAS LIGHTING AND EXTINGUISHING APPARATUS.—John Vansant, San Francisco, Cal.—This invention has for its object to produce an apparatus by means of which gas can be lighted and extinguished on a suitable number of burners in rapid succession, and without requiring the handling of, or personal contact with, each burner or its gas pipe. The invention consists in the application to each gas pipe, or burner, of an electric apparatus, by means of which the valve, for admitting the gas to the burner or withholding it from the same, will be opened or closed whenever the currents are directed in the appropriate manner.

PADLOCK.—George Merkel and Charles H. Meyer, New York city.—This invention relates to a new padlock, and has for its object to make the picking of the same more difficult than in ordinary padlocks, and also to facilitate the operation of the same by the right key.

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CLOTHES PIN.—K. H. Goss, Cedar Springs, Mich.—This invention relates to improvements in clothes pins, and it consists in a piece of wire having one or more coils at the center, and a sharp bend in each part below the coils at the termination of which the two parts cross, and beyond these bends the said two parts are bent backward beyond the coils, to form levers for opening the pin, and terminate in finger pieces suited to grasp between the thumb and finger for opening the bent parts below the coil for attaching to the clothes line.

AWNING FRAME FOR ANIMALS.—Simon Moffitt, Minneapolis, Minn.—This invention relates to an awning to be attached to the pole of a two-horse wagon, for the purpose of protecting the animals, when harnessed to the wagon, from the action of sun and rain.

CEILING FOR STAGES.—J. W. Dunne, New York city.—This invention relates to an improvement in ceilings which are to be used on the stages of theatres, opera houses, etc., to complete and perfect the display of scenery.

MATCH SAFE.—William Stine, Elmore, Ohio.—This invention relates to a new match safe, which is so constructed that the matches can successively and singly be removed from the same without requiring the opening of the main lid or cover.

WATER AND WIND WHEEL.—Andrew Folsom, Eastport, Me.—This invention relates to a new water or wind wheel, which is so constructed that it will serve to revolve its shaft whenever it is exposed to a current of liquid or air, whatever the direction from which the same may come.

WIND MILL.—Peter Bailey, Smyrna, Iowa.—This invention relates to a wind-mill constructed with a double wind wheel, the two parts of which are mounted, side by side, on the same shaft, and revolve in opposite directions. The apparatus is supplied with rudders, that have adjustable wings, by regulating which the wind wheels may be kept face to the wind, or inclined to the wind, or side to the wind, at pleasure, the wheels, when in this ast mentioned position, being stopped.

WINDOW-SILL AND FIRE-ESCAPE.—George Laynor and Harry Helmling, Baltimore, Md.—This invention consists in arranging in a window-sill, made as a box, and having a cover that turns back, and a side or sides that turn down, a fire escape ladder, so constructed that it may be folded compactly within the sill, and there stored till wanted for use, when the sill may be opened, and the ladder unfolded and let down the side of the building. The invention also consists in so constructing the ladder that the several sections thereof fold one within another, so as to occupy a minimum of space.

ILLUMINATING APPARATUS.—F. H. Lutkewitte, St. Louis, Mo.—This invention consists of a series of small hydrogen chambers, filled with absorbent, and arranged in a series of sections, which may be shut off from one another, to graduate the amount of oil through which the air passes, and its time of contact therewith, according to the temperature and season of the year.

CIDER OR WINE MILL.—W. B. Farrar, Greensboro, N. C.—This invention relates to a cider or wine mill, in which the unbroken fruit is first placed in a press-box, wherein, by the moving of the platen, it is fed up to the revolving grinding cylinder, and thereby reduced to pomace; and in which the pomace is then replaced in the same box, and, by the operation of the platen, forced again against the grinding cylinder, which now stands still, whereby the juice is expressed from the pomace, the same box thus serving to hold the fruit to both while grinding and pressing.

COTTON PRESS.—C. C. Conner, D.D., Ripley, Tenn.—This invention relates to an improvement in presses, in which the platen is raised and lowered by the action of two complementary sets of cables or ropes operated by one and the same set of vertical shafts, one set of ropes being unwound from the shaft as the other is wound upon them, and *vice versa*.

HAY LOADER.—L. D. Taylor, Granville Center, Pa.—This invention relates to a new hay-loader, which is to follow a wagon for the purpose of transferring the hay to the same. The invention consists in a new arrangement of inclined rake-heads, which receive their motion from two crank shafts, so that they will serve to elevate the hay gradually to the top of the wagon; also in the combination of the same with a fixed inclined platform having detaining teeth.

ROTARY STEAM ENGINE.—T. S. La France, Elmira, N. Y.—This invention relates to a new rotary engine, of the class composed of two toothed drums or wheels within a fixed case, the drums being revolved by the pressure of steam against their teeth.

LOOM.—W. R. Gifford, W. R. Gifford, Jr., and J. A. Gifford, Piscataqua Co., Me.—This invention relates to improvements in hand looms, and consists in certain novel arrangements of apparatus for setting the spring for acting the picket staves by the action of the lathe, the same being accomplished during the backward movement, so that on the forward movement, the whole power may be applied to the reed in beating up. The invention also comprises improvements in the arrangement of the driving shaft and the apparatus for operating the lathe by which the treddles and the yarn beam are operated, and it also comprises improvements in the part of the frame which supports the cam shaft and the yarn beam, calculated to facilitate packing for shipment.

FEEDER FOR NAIL MACHINES.—H. B. Landers, Williamsburgh, N. Y.—The object of this invention is to provide a mechanism whereby plate iron can be fed to the cutting apparatus of a nail machine at such regular intervals that the blanks can be cut therefrom with the desired velocity.

ASH SIFTER.—G. W. Rogers, New York city.—This invention relates to a new ash sifter, in which an oscillating sieve is employed, the same being supported on an U-shaped rock shaft, from which it can be readily detached. A very convenient and reliable ash sifter is thereby produced.

EEL TRAP FOR WATER PIPES.—J. J. Dutcher, New Haven, Conn.—The object of this invention is to provide an eel trap at the extreme end of the water pipe, let into a main or reservoir, so that the eels cannot enter a portion of the pipe.

BOLT.—William C. Coles, Williamsburgh, N. Y.—This invention has for its object to furnish a neat, simple, and convenient bolt for window sashes, doors, etc.

PLATFORM SPRING COUPLING.—Benjamin T. Parsels and John L. Hedges, Hanover, N. J.—This invention has for its object to furnish an improved coupling for platform springs, which shall be simple in construction, strong, and durable, and which will allow the springs to lengthen under pressure, without twisting or straining them.

CHURN DASHER.—Stephen Stout, Tremont, Ill.—This invention has for its object to furnish an improved churn dasher, simple in construction and effective in operation, bringing the butter in a very short time, and gathering it, when brought, quickly into a mass.

FOUNTAIN PAINT BRUSH.—Daniel J. Kellogg, Toledo, Ohio.—This invention has for its object to improve the construction of the improved fountain paint brush, patented, by the same inventor, January 17, 1871, and numbered 110,978, so as to make it more convenient in use, and more effective in operation.

COVERING FOR MELTING POTS.—Albert C. Lewis, New York city.—This invention has for its object to furnish an improved covering for melting pots, to protect them from being injured by the intense heat, and by the adhesion of the coals.

ANIMAL TRAP.—C. R. Veronee, Athens, Ga.—This invention relates to a new and useful improvement in traps for catching rats and other animals.

SPINDLE BEARING.—Charles Wilson, Brooklyn, N. Y.—This invention relates to a new and useful improvement in bearings or boxes for upright spindles, in spinning frames in cotton or woolen manufactories, and for other upright journals.

TUBULAR STEAM BOILER.—James Howard and Edward Tenney Bousfield, Bedford, England.—This improved boiler is constructed of sections or a group of tubes, so arranged that the main connecting tube of each section will be in or approach a vertical position, with smaller tubes projecting from one side of it, say at right angles thereto, and secured to it by any approved method. The tubes which stand out at right angles to the main tube, we prefer to connect by water and steam warp with each other at both ends.

WAREHOUSE TRUCKS.—John S. Cochran, New York city.—This invention relates to a new and useful improvement in trucks for warehouses, stores, etc.

MILLSTONE BALANCE.—J. A. Althouse, New Harmony, Ind.—This invention relates to a new and useful device for balancing millstones, and consists in a weight or weights, made adjustable on the side or sides of the stone, by means of slotted bars and plates.

WAGON BRAKE.—Abraham Quinn, Brooklyn, N. Y.—This invention relates to improvements in brakes for wagons, and it consists in a shoe, suspended by bars from the axle eccentrically to the axles, so that when let fall under the wheel it will bind firmly against the rim, which said shoe is held out of action by a chain and hand lever, arranged for readily letting it fall in case the horses attempt to run, and the said shoe is connected by a drag chain to the check rein in such a way that when it falls down under the wheel to its working position, it will check up the horse.

ROTARY STEAM ENGINE.—William Barry, Carthage, N. Y.—This invention relates to improvements in rotary steam engines, and consists in a rotary hub or wheel, with a conical face, in which is a groove or channel for the steam, with taper sides, in which groove fills a tapered stop, for separating the live steam from the exhaust, projecting through a case, having an inner face corresponding to and fitting around the hub, in which are two pistons, on which the steam acts, fitted in grooves traversing the steam groove, and arranged for sliding out to pass the stop and in again by the action of a cam groove or a cam and a spring.

SAWING MACHINE.—Wm. W. Waterbury and Jno. M. Waterbury, New Canaan, Conn.—This invention relates to improvements in foot power circular sawing machines, and it consists in the application to a bench having the saw mounted in the usual way, and multiplying gear for increasing the motion, of a tread wheel on the main driving shaft, for applying the power by treading thereon.

EXTENSION LADDERS.—R. F. Delmot, Flemington, Pa.—This invention relates to improvements in extension ladders, and consists in jointing the sections together by means of trunnions on the one section, arranged in angle plates attached to the other sections, having right-angled slots, and arranged so that one part of the slot is parallel with the bars of the section to which the said plates are attached, and the other parts are perpendicular thereto; and to the rods connecting the bars, so that one section may swing on the other, and slide up and down on it.

MIXED FELTED GOODS.—Theo. Demuth, Danbury, Conn.—The nature of this invention consists in the preparation of woolen or cotton yarn, of different colors, to be applied to the wool in process of manufacture, for imparting the mixed character by a solution of gum shellac, or other suitable resinous or glutinous substance, for the purpose of keeping the same intact and distinct, and preventing the assimilation and entanglement of its fibers with those of the wool with which it is mixed, in the process of carding and fulling, thereby producing a new and distinct mixed felted fabric, which cannot be obtained with the same materials without such preparation of the yarn.

# Official List of Patents.

## ISSUED BY THE U. S. PATENT OFFICE.

FOR THE WEEK ENDING APRIL 4, 1871.

*Reported Officially for the Scientific American.*

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**MUNN & CO.,**
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113,238.—MACHINE FOR MAKING BOXES.—E. G. Alden, Cambridge, Mass.

113,239.—MANNER OF PACKING AND CONVEYING ICE CREAMS, WATER ICES, ETC.—Ignazio Allegrettl, Philadelphia, Pa. Antedated March 29, 1871.

113,240.—MAGNETIC-ELECTRO DIAL TELEGRAPH.—George L. Anders, Boston, Mass.

113,241.—STEAM COOKING RANGE.—John Ashcroft (assignor to Sarah Jane Ashcroft), Brooklyn, N. Y.

113,242.—FLUTING MACHINE.—S. William Babbitt, West Meriden, Conn.

113,243.—WINDMILL.—Peter Bailey, Smyrna, Iowa.

113,244.—BRUSH, BROOM, AND MOP HOLDER.—Charles L. W. Baker (assignor to C. L. W. Baker & Co.), Hartford, Conn.

113,245.—DAMPER FOR CHIMNEYS.—Peter Baker, Oakland, Md.

113,246.—POWER PRESS.—C. J. Beasley (assignor to Tappey, Lumsden & Co.), Petersburgh, Va.

113,247.—VALVE FOR STEAM PUMPS.—John V. V. Booraem, Jersey City, N. J. Antedated March 23, 1871.

113,248.—VALVE FOR STEAM PUMPS.—John V. V. Booraem, Jersey City, N. J. Antedated March 23, 1871.

113,249.—APPARATUS FOR CASTING.—John P. Broadmeadow, Bridgeport, Conn.

113,250.—MANUFACTURE OF SALT.—J. R. Buchanan, Louisville, Ky. Antedated March 21, 1871.

113,251.—CHURN.—W. E. Budd, Chatham, N. J.

113,252.—STEAM AND HYDRAULIC PACKING.—W. M. Canfield, Philadelphia, Pa.

113,253.—HORSE COLLAR AND HAME.—Otho Cann, Coldwater, Mich.

113,254.—WASHING MACHINE.—C. E. Carter, Martinsville, Ohio.

113,255.—ROLL FOR ROLLING HORSESHOE BARS.—Ebenezer Cate, East Woburn, Mass.

113,256.—PAPER-CUTTING AND FOLDING MACHINE.—Cyrus Chambers, Jr., Philadelphia, Pa.

113,257.—PAPER-CUTTING AND FOLDING MACHINE.—Cyrus Chambers, Jr. (assignor to Edward Chambers and Cyrus Chambers, Jr.), Philadelphia, Pa.

113,238.—RUBBER AND BRUSH.—Augustus Charles, Pittsburgh, Pa.

113,259.—GAITER.—Peter E. Clark, Hartford, Conn.

113,260.—DEVICE FOR PREPARING BEEFSTEAK FOR BROILING.—W. A. Clark, Woodbridge, Conn.

113,261.—SHOEMAKERS' PINCERS.—Alfred Clarke, Philadelphia, Pa.

113,262.—CUTTER HEAD FOR PLANING MACHINES.—Henry Climer and C. E. McBeth, Hamilton, Ohio.

113,263.—WAREHOUSE TRUCK.—John S. Cochran, New York city.

113,264.—BOLT.—W. C. Coles, Williamsburgh, N. Y.

113,265.—COTTON PRESS.—C. C. Conner, Ripley, Tenn.

113,266.—STOOL OR TABLE.—Albert O. Crane, Boston, Mass. Antedated March 24, 1871.

113,267.—CAMERA STAND.—Aylett R. Crihfield, Lincoln, Ill.

113,268.—STAVE JOINTER.—Harry A. Crossley, Cleveland, Ohio.

113,299.—CHEMICALLY-PREPARED LAMPWICK.—Aaron M. Daniels Hartford, Conn

113,270.—SPRING FOR VEHICLES.—J. N. Decker (assignor to himself and Thomas J. Smith), Covington, Ky. Antedated March 21 1871.

113,271.—FLUTING MACHINE.—E. M. Deey, New York city.

113,272.—MANUFACTURE OF BILLIARD BALLS AND OTHER COMPOSITION ARTICLES.—Lewis Deitz, B. P. Wayne, and Albern Stone Albany, N. Y. Antedated March 22, 1871.

113,273.—EXTENSION LADDER.—R. F. Delmont, Flemington Pa.

113,274.—FELTED FABRIC.—Theodore Demuth, Danbury Conn.

113,275.—SASH HOLDER.—John F. Dingee, Bedford Station N. Y.

113,276 —LITHOGRAPHIC PRINTING.—Otto Dubois, Fall River Mass.

113,277.—CEILING FOR STAGES.—John W. Dunne, New York city.

113,278.—EEL TRAP FOR WATER PIPES.—J. J. Dutcher (assignor to G. W. Dutcher), New Haven, Conn.

113,279.—PURIFYING ANIMAL CHARCOAL.—Hermann Eissfeldt, Sollingen, Duchy of Brunswick, and Camillo Thumb, Magdeburg Prussia.

113,280.—BOLT HEADING DIE.—Philip Eley, New York city, assignor, by mesne assignments, to Charles Wallich, George Hicock, and Alexander Young.

113,281.—WATCH REGULATOR.—Julius Elson, Boston, Mass

113,282.—GATE.—J. B. Erwin, Pittsburgh, Pa.

113,283.—CIDER AND WINE MILL.—W. B. Farrar, Greensborough, N. C.

113,284.—WATER AND WIND WHEEL.—Andrew Folsom Eastport, Me.

113,285.—WAGON JACK.—George Benedict Fowler, Brooklyn, N. Y.

113,286.—HARROW.—William Fox, Beaver Dam, Wis. Antedated March 18, 1871.

113,287.—CHAIR.—George Gardner, Glen Gardner, N. J.

113,288.—LOOM.—W. R. Giffard, W. R. Giffard, Jr., and J. A Giffard, Milo, Me.

113,289.—CLOTHES PIN.—Keyes J. Goss, Cedar Springs, Mich.

113,290.—RAILROAD CAR BRAKE.—John C. Gove, Cleveland, Ohio.

113,291.—PAPER FEEDER.—John A. Graves, Washington, D. C. Antedated April 1, 1871.

113,292.—FISH TRAP.—Job E. Hammond, New Bedford, Mass. Antedated March 24, 1871.

113,293.—DUMPING CART.—William Hand, Plainfield, N. J.

113,294.—GATE.—U. W. Hardy, Abingdon, Ill.

113,295.—PIN LOCK.—August Hermann and W. H. Taylor (assignors to the Yale Lock Manufacturing Co.), Stamford, Conn.

113,296.—GRAIN SCOURER AND SEPARATOR.—S. H. Hinsdell, H. W. Drake, and C. B. Way, Camillus, N. Y.

113,297.—WOOD PULP MACHINE.—W. M. Howland, Topsham, Me.

113,298.—TUBULAR STEAM BOILER.—James Howard and E. T. Bousfield, Bedford, England.

113,299.—AUTOMATIC APPARATUS FOR OPERATING THE VALVE OF THE EXHAUST PIPE OF LOCOMOTIVES.—Ralph C. Huse, Jr. Georgetown, Mass.

113,300.—BRICK AND TILE MACHINE.—William Hutchinson Salford, Great Britain.

113,301.—WINDOW BLIND OPERATOR.—George Jennisen and M. F. Otis, Westborough, Mass.

113,302.—MILK COOLER.—Nelson Johnson and R. E. Johnson, Jasper, N. Y. Antedated March 21, 1871.

113,303.—SASH HOLDER.—Wm. G. Jones and S. M. Rankin, Long Green, Md.

113,304.—COMBINED CHAIR AND STEP LADDER.—Ib Jórgensen and Rasmus Olson, Racine, Wis.

113,305.—FOUNTAIN PAINT BRUSH.—D. J. Kellogg, Toledo Ohio.

113,306.—CULTIVATOR.—A. H. Kennedy, Oberlin, Ohio.

113,307.—ROLLING BED.—Julius Krisch and Charles Thoener, New York city.

113,308.—POTATO DIGGER.—J. P. Lafreta, Shrewsbury, N. J

113,309.—ROTARY STEAM ENGINE.—J. S. La France, Elmira N. Y.

113,310.—FEEDER FOR NAIL MACHINE.—H. B. Landers, Williamsburgh, N. Y.

113,311.—FIRE ESCAPE.—George Laynor and Harry Helmling, Baltimore, Md.

113,312.—COVERING FOR MELTING POTS.—A. C. Lewis (assignor to himself, H. A. Richardson, and N. A. Boynton), New York city.

113,313.—CLOTHES PIN.—A. B. Lipsey, West Hoboken, N. J.

113,314.—MACHINE FOR TAPPING GAS AND WATER FITTINGS.—C. B. Long, Worcester, Mass.

113,315.—COVER AND DESK FOR SEWING MACHINES.—B. T. Loomis and J. A. Carey, New York city.

113,316.—COMBINATION LOCK.—Samuel Loyd, New York city.

113,317.—APPARATUS FOR CARBURETING AIR AND GAS.—F. H. Lutkewitte, St. Louis, Mo.

113,318.—SWIVEL PIN FOR TETHERING ANIMALS.—William Lyon, Camp Halleck, Nevada.

113,319.—PAPER BOX.—B. J. Magee and J. F. Wall, Watertown, Mass.

113,320.—COTTON SCRAPER, HILLER AND CULTIVATOR.—Cyrus Marsh, 2d, Natchez, Miss.

113,321.—HARVESTER RAKE.—Alexander McArthur, Booneville, Mo.

113,332.—PADLOCK.—George Merkel and C. H. Meyer, New York city.

113,323.—AWNING FOR ANIMALS.—Simon Moffitt, Minneapolis, Minn.

113,324.—FURNACE GRATE.—G. R. Moore, Philadelphia, Pa.

113,325.—MACHINE FOR WINDING BOBBINS.—F. H. Morrill, Philadelphia, Pa.

113,326.—MACHINE FOR CORKING BOTTLES.—David Mueller (assignor to himself and Franz Wagner), New York city.

113,327.—MODE OF PREPARING PAPER FOR PHOTOGRAPHIC PURPOSES.—P. H. Murray, Portsmouth, Ohio.

113,328.—WATER-PROOF CELLAR.—Tobias New, Brooklyn, N. Y.

113,329.—FIRE ESCAPE.—G. H. Nichols, Richmond, Va.

113,330.—COMB.—C. H. Noyes, Brooklyn, N. Y.

113,331.—ORNAMENTING THE SURFACE OF METAL BY ELECTRO-DEPOSITION FROM SOLUTIONS.—Richard O'Neil, New York city.

113,332.—MACHINE FOR ROLLING HOLLOW BARS FOR NUTS.—Jonathan Ostrander, Manchester, Va.

113,333.—EXTENSION LOUNGE.—J. S. Paine, Cambridge, Mass.

113,334.—GATE.—B. F. Palmer, Baraboo, Wis.

113,335.—PLATFORM SPRING COUPLING.—B. T. Parsels and J. L. Hedges, Hanover, N. J.

113,336.—LAWN MOWER.—E. G. Passmore, Philadelphia, Pa.

113,337.—STOP VALVE.—J. L. Peake, New York city.

113,338.—PORTABLE APPARATUS FOR PRESERVING WOOD.—W. T. Pelton, New York city.

113,339.—APPARATUS FOR STRIPPING THE TOP FLATS OF CARDING MACHINES.—E. C. Pfaff, Chemnitz, Saxony, assignor to Dobson & Barlow.

113,340.—COMB.—Leonce Picot, Hudson City, N. J.

113,341.—SHOVEL PLOW.—S. W. Pope, Louisville, Ky.

113,342.—ADJUSTABLE SEAT.—Louis Postawka, East Cambridge, Mass.

113,343.—PRINTING SILKS AND OTHER TEXTILE FABRICS.—Louis Prang, Boston, Mass.

113,344.—DRILL STOCK.—W. H. Rand, Brooklyn, N. Y.

113,345.—FIELD THRASHING MACHINE.—George Rieke, Kairo Township, Minn.

113,346.—PRINTING PRESS.—J. T. Robertson, New York city

113,347.—CLOTHES-WRINGING PRESS.—Charles Robinson Boston, Mass.

113,348.—RAILROAD CAR HEATER.—A. M. Rodgers, Brooklyn, N. Y.

113,349.—ASH SIFTER.—G. W. Rogers, New York city.

113,350.—MACHINE FOR CHANNELING AND BEVELING SOLES FOR BOOTS AND SHOES.—J. G. Ross, Philadelphia, Pa.

113,351.—FOOT SCRAPER.—August Sahlstrom, Chicago, Ill.

113,352.—WASHING AND WRINGING MACHINE.—J. S. Sandt St Joseph, Mo.

113,353 —COAL-DELIVERING SACK.—W. S. Shackleton, Cleveland, Ohio.

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113,354.—HOLD-BACK FOR VEHICLES.—N. W. Simons, Williamsfield, Ohio.
113,355.—FEED WATER HEATER.—T. D. Simpson, Mount Vernon, Ohio.
113,356.—CRACKER MACHINE.—G. R. Skillman (assignor to himself and James Beatty), Baltimore, Md.
113,357.—FIRE ESCAPE.—G. C. Smith and F. M. Burrows, Baltimore, Md.
113,358.—WHISK BROOM.—Greenleaf Stackpole, Elizabeth, N. J.
113,359.—MAIL-BAG FASTENER.—H. M. Stephenson and J. B. Tyer, Wabash, Ind.
113,360.—MATCH SAFE.—Wlliam Stine, Elmore, Ohio, assignor to himself and H. R. Lyle, Pilatka, Fla.
113,361.—CHURN DASHER.—Stephen Stout, Tremont, Ill.
113,362.—HOISTING APPARATUS.—L. W. Stuart, Narrowsburg, N. Y. Antedated March 23, 1871.
113,363.—HAY LOADER.—L. D. Taylor, Granville Center, Pa.
113,364.—WINDOW-SHADE FIXTURE.—Nathan Thompson, Brooklyn, N. Y.
113,365.—COATING LAMPS.—G. W. Thomson, Buffalo, N. Y.
113,366.—WATER METER.—I. P. Tice, New York city.
113,367.—COTTON SCRAPER.—T. H. Trantham, De Soto county, Miss. Antedated March 29, 1871.
113,368.—RUBBER PAINT.—Samuel Truscott, Cleveland, Ohio.
113,369.—PORTABLE DUMPING HOD FOR EARTH CLOSETS.—E, W. C. Vanderveer, Elizabeth, N. J.
113,370.—ELECTRIC GAS LIGHTING AND EXTINGUISHING APPARATUS.—John Vansant, San Francisco, Cal.
113,371.—ANIMAL TRAP.—C. B. Veronee, Athens, Ga.
113,372.—BED LOUNGE.—Valentine von Dissen, New York city.
113,373.—POTATO DIGGER.—J. A. Wadhams, Blue Island, Ill.
113,374.—COFFER DAM.—J. E. Walsh, New York city.
113,375.—SAWING MACHINE.—W. W. Waterbury, and J. M. Waterbury, New Canaan, Conn.
113,376.—VOTE-RECORDING MACHINE.—Adan Weston, Keeseville, N. Y.
113,377.—COMBINED LOCK AND LATCH.—S. H. Wheeler, Dowagiac, Mich.
113,378.—HINGE.—Shepherd H. Wheeler (assignor to himself, Enos L. Chappell, and Guy E. Chappell), Dowagiac, Mich.
113,379.—FOOT LIFTER FOR BLACKSMITHS.—T. C. Williams, Warrentown, Mo.
113,380.—SPINDLE BEARING.—Charles F. Wilson, Brooklyn, N. Y.
113,381.—LIFTING JACK.—Hiram J. Wilson, Mason, Mich.
113,382.—CRIB ATTACHMENT FOR BEDSTEADS.—J. H. L Wilson, Auburn, Kansas.
113,383.—COMBINED COTTON SEED PLANTER AND CULTIVATOR.—James A. Wright, Marietta, Ga.
113,384.—CHEST EXPANDER.—Samuel L. Barnett, New York city.
113,385.—SPRING BED BOTTOM.—L. M. Bates, Cleveland, Ohio. Antedated March 27, 1871.
113,386.—CHEEK PIECE FOR SHIPS' MASTS.—Joseph Baymore, Philadelphia, Pa.
113,387.—ADJUSTABLE CARRIAGE SEAT.—Sylvester W.Beach, Ypsilanti, Mich.
113,388.—ATTACHING MARBLE TOPS AND BACKS OF WASHSTANDS.—Wm. J. Bender, Cincinnati, Ohio.
113,389.—DOOR MAT.—Norborne Berkeley, Aldie, Va.
113,390.—GANG AND SUBSOIL PLOW.—Joel L. Bond, Marshaltown, Iowa.
113,391.—SEWING MACHINE.—Thomas W. Bracher, New York city.
113,392.—CORSET.—Morris P. Bray, Birmingham, Conn.
113,393.—MODE OF MAKING TELEGRAPH INSULATORS.—Wm. Brookfield, New York city.
113,394.—PACKAGE FOR HYDROCARBON AND OTHER LIQUIDS.—Morgan W. Brown, New York city.
113,395.—PACKAGE FOR OYSTERS, CLAMS, ETC.—Morgan W. Brown, New York city.
113,396.—COVERING FOR SAUSAGES AND OTHER MEATS.—Morgan W. Brown, New York city.
113,397.—PUMP VALVE.—Adam S. Cameron, New York city
113,398.—TOWEL BRACKET AND SPONGE HOLDER.—J. F. Chandler, Boston, Mass.
113,399.—ELECTRIC BATTERY FOR TELEGRAPHING AND OTHER PURPOSES.—Daniel M. Cook, Mansfield, Ohio.
113,400.—WATER WHEEL.—Gardner Cox, Pierpont, N. Y.
113,401.—SMELTING IRON AND OTHER ORES.—R. D. Cox and W. F. Cox, Philadelphia, Pa.
113,402.—CHILD'S CARRIAGE OR PERAMBULATOR.—Benj. P. Crandall, Jr., Williamsburgh, N. Y.
113,403.—SUSPENDING SIGN, ETC.—John H. Crane and Chas. W. Crane, Boston, Mass.
113,404.—STREET-SPRINKLING MACHINE.—S. E. Cursons, Buffalo, N. Y.
113,405.—SEDIMENT COLLECTOR FOR STEAM BOILERS.—C. W. Deane, Philadelphia, Pa.
113,406.—TRACE BUCKLE.—Myron H. Dinsmore (assignor to himself, Milton J. Snyder, and Aaron Briggs), Shickshinny, Pa.
113,407.—SEWING MACHINE.—Alfred S. Dinsmore, Boston, Mass.
113,408.—BREECH-LOADING FIREARM.—William C. Dodge, Washington, D. C.
113,409.—ADVERTISING DEVICE.—James F. Emery, Albany, assignor to himself and James E. Thomson, Buffalo, N. Y.
113,410.—HORSE POWER.—Thomas Addis Emmet Evans, Albany, Ga.
113,411.—EARTH CLOSET.—Benjamin Ferris, Wilmington, Del.
113,412.—SAW MILL.—George Finnegan, Dublin, Ireland.
113,413.—STOVE DRUM.—Charles Fisher (assignor to himself and Henry N. Wilcox), Niles, Mich.
113,414.—TUMBLER FOR PERMUTATION LOCKS.—Charles Flesch, Rochester, N. Y.
113,415.—LET-OFF MECHANISM FOR LOOMS.—William T. Flinn (assignor to himself and Jacob Steinmetz Thorn), Philadelphia, Pa.
113,416.—TREATMENT OF SEWAGE AND THE MANUFACTURE OF FERTILIZERS.—David Forbes, York Place, Portman Square, and A. P. Price, Lincoln's Inn-Fields, England.
113,417.—MOTIVE-POWER APPARATUS.—J. T. Gilbert, Asbury, Ill.
113,418.—SKELETON CORSET.—T. S. Gilbert, Birmingham, Conn.
113,419.—CORSET.—Thomas S. Gilbert, Birmingham, Conn.
113,420.—BOOT AND SHOE SOLES.—Charles Goodyear, Jr., New Rochelle, and Joze De Silva, Williamsburgh, N. Y., assignors to Charles Goodyear, Jr.
113,421.—PLOW COLTER.—Charles M. Gordon, La Porte, Ind.
113,422.—CORN PLANTER.—Lewis Graham, Plymouth, Ill.
113,423.—MANUFACTURE OF PEAT FUEL.—R. A. Griffin, Montreal, Canada.
113,424.—FURNACE FOR STEAM BOILERS.—John C. Gripp, Pittsburgh, Pa.
113,425.—RAILWAY-BRIDGE SIGNAL APPARATUS.—T. S. Hall, New Haven, Conn.
113,426.—COMPOSITION FOR COATING PHOTOGRAPH PICTURES. Happel, New York city.
113,427.—ROLLED METALLIC STRIPS FOR WASHERS.—T. C. Hargrave, Boston, Mass.
113,428.—VALVE AND VALVE GEAR.—William Z. Hatcher (assignor to himself and William L. Lance), Plymouth, Pa.
113,429.—COAL SCUTTLE.—G. H. Hazelton and D. W. Hazelton, Philadelphia, Pa.
113,430.—BOOT CRIMPER.—Henry Henley, Shoals, Ind.
113,431.—BULLET PATCH.—Alfred C. Hobbs, Bridgeport, Conn.
113,432.—MACHINE FOR FORMING HEEL RANDS.—Sumner Holmes, North Brookfield, and Joseph F. Sargent, Melrose, Mass.
113,433.—GRINDING PLATE.—Edmund S. Howland, Batavia, Ill.
113,434.—STEAM TRAP.—J. J. Jordan (assignor to himself and G. T. Carter), Philadelphia, Pa.
113,435.—APPARATUS FOR OPERATING CHURNS.—Preston L. Jordan, Lexington, Miss.
113,436.—PLOW.—John Lane, Jr., Chicago, Ill.
113,437.—COOKING STOVE.—E. C. Little, and D. H. Nation, St. Louis, Mo.
113,438.—APPARATUS FOR COOLING MILK.—John R. McKay, Rockton, Ill.
113,439.—MANUFACTURE OF EMERY WHEELS AND ARTIFICIAL STONE.—Edgar C. Merrill, Charleston, Vt.
113,440.—APPARATUS FOR DRAWING WATER FROM WELLS. Merrick A. Mihills, Lodi, Ohio.
113,441.—WHEEL FOR VEHICLES.—J. R. Mills, Macon City, Mo.
113,442.—CULINARY VESSEL.—William H. Murch, Portland, Me.
113,443.—FLOUR SIFTER.—Oliver D. Myers, Doylestown, Pa.
113,444.—WASHING MACHINE.—John Osmun and John Curl, Rockport, N. J.
113,445.—SELF-ACTING MULE FOR SPINNING.—C. B. Parkinson, Aaron Metcalf, John Metcalf, and Wm. H. Heald, Preston, Great Britain.
113,446.—MACHINE FOR POUNCING HATS.—Augustus Pelisse and George W. Stoute, Newark, N. J.
113,447.—HOT AIR REGISTER.—Hugh M. Phinney, Boston, Mass.
113,448.—SAD IRON.—Mary Florence Potts, Ottumwa, Iowa.
113,449.—POTATO DIGGER.—John P. Radley, Albany, N. Y.
113,450.—ICE CREAM FREEZER.—John Franklin Rote, Reading, Pa.
113,451.—SPRING FOR WHEELED VEHICLES.—Cyrus W. Saladee, St. Catharine's, Canada.
113,452.—TABLE-LEAF SUPPORT.—Daniel Saylor and Lauritz Anderson, Chicago, Ill.
113,453.—APPARATUS FOR SPREADING MEDICAL PLASTERS.—Adolph J. Schafhirt, Washington, D. C.
113,454.—TREATING PAPER AND VEGETABLE FIBROUS SUBSTANCES.—Augustus T. Schmdt, Pittsburgh, Pa.
113,455.—SAFETY VALVE.—Matthew Scrannage and Edward Scrannage, Jr. (assignors to Scrannage, Bate & Co.), Boston, Mass.
113,456.—CORN SALVE.—Anthony Seabold, Florence, Ohio.
113,457.—MOP HEAD.—Samuel Selden and Matthew Griswold, Jr., Erie, Pa.
113,458.—WAGON BOLSTER STAKE.—Lewis Washington Shaeffer, Elizabethtown, Ky.
113,459.—COMPOUND FOR CURE OF FOOT ROT IN SHEEP.—William T. Sherman, Marengo, Ohio.
113,460.—FIRE ALARM.—Horatio N. Shultz, Mechanicstown, Md.
113,461.—BIRD CAGE MAT.—Isaac A. Singer, New York city.
113,462.—CAR COUPLING.—George C. Spangler (assignor to himself and Simpson H. Daft), Allegheny City, Pa.
113,463.—FRICTION CONDENSER FOR ILLUMINATING GAS.—William H. St. John, Brooklyn, N. Y., and Samuel O. Rockwell, Jersey City, N. J.
113,464.—CUTTER HEAD.—Alonzo Louis Sweet, Norwich, Conn.
113,465.—PERMUTATION LOCK.—William Terwilliger, New York city, assignor to himself and Frederick H. North, New Britain, Conn.
113,466.—TUBULAR STEAM BOILER.—Charles A. Thompson, Flushing, N. Y.
113,467.—FASTENING FOR MEETING RAILS OF SASHES.—Nathan Thompson, Brooklyn, N. Y.
113,468.—HALTER.—James Thornton (assignor to himself and E. G. Latta), Wellsville, N. Y.
113,469.—ATTACHMENT TO HAMES.—James Thornton and Emmit G. Latta, Wellsville, N. Y.
113,470.—BREECH-LOADING FIREARMS.—Frank Tiesing and Charles Gerner (assignors to Eli Whitney), New Haven, Conn.
113,471.—SHIP'S TRESTLE TREE.—Henry Townsend, Philadelphia, Pa. Antedated March 22, 1871.
113,472.—LAMP BURNER.—Joseph Trent, Millerton, N. Y.
113,473.—BASE BURNING STOVE.—Jaspar Van Wormer (assignor to himself and Michael McGarvey), Albany, N. Y.
113,474.—HARVESTER RAKE.—Cyrenus Wheeler, Jr., Auburn, N. Y.
113,475.—HARVESTER.—Cyrenus Wheeler, Jr., and Calvin Young, Auburn, N. Y.
113,476.—MOVABLE PARTITION.—Douglas Joseph Williams, Birmingham, England.
113,477.—BLOCK FOR TOP-PROP JOINTS FOR CARRIAGES.—John J. Wilson, New York city.

## REISSUES.

4,317.—SLIDE FOR EXTENSION TABLE.—Merrill E. Carter, Syracuse, and Elisha Mets, Rochester, N. Y.; Elisha Mets assignor, by mesne assignments, to Hayden & Hahn.—Patent No. 44,078, dated Sept. 6, 1864.
4,318.—WATER PITCHER AND OTHER VESSELS.—Kingston Goddard, Richmond, N. Y., assignor to himself and John P. Adams.—Patent No 97,380, dated November 30, 1869.
4,319.—PISTON STEAM VALVE.—Robert C. Gray and William B. Brittingham, LaFayette, Ind., assignors to themselves and John Fordyce.—Patent No. 86,067, dated January 19, 1869.
4,320.—Division A.—MANUFACTURE OF ALIZARINE.—Charles Graebe, Frankfort-on-the-Main, and Charles Leibermann, Berlin, Prussia.—Patent No. 95,465, dated October 5, 1869.
4,321.—Division B.—DYES OR COLORING MATTER FROM ANTHRACINE.—Charles Graebe, Frankfort-on the-Main, and Charles Liebermann, Berlin, Prussia.—Patent No. 95,465, dated October 5, 1869.
4,322.—CARRIAGE WHEEL.—Robert W. McClelland, Springfield, Ill.—Patent No. 99,691, dated February 8, 1870.
4,323.—MANUFACTURE OF GERMAN HAND CHEESE.—Francis C. Mende and Theodore F. Mende, Philadelphia, Pa.—Patent No. 95,500, dated October 5, 1869.
4,324.—MACHINE FOR TIGHTENING ROPES, ETC.—Arthur Paget, Loughborough, England.—Patent No. 105,240, dated July 12, 1870; antedated April 21, 1868.
4,325.—HARNESS FOR HORSES.—John Rouse, Palmyra, N. Y.—Patent No. 25,587, dated September 27, 1859.
4,326.—ELECTRO-MAGNETIC REGULATOR FOR TEMPERATURE IN ROOMS, ETC.—George Miller Sternberg, New York city.—Dated No. 100,462, dated March 1, 1870.
4,327.—COTTON PRESS.—Paul Williams, Winona, Miss., assignor to Robert A. Williams and James L. Williams.—Patent No. 73,683, dated January 21, 1868.

## DESIGNS.

4,746.—HITCHING POST CAP.—Roger S. Austin, Wallingford, Conn.
4,747.—GANG PRESS.—Wellington Denison (assignor to himself and Joseph H. Knight), Rome, N. Y.
4,748.—TELEGRAPHER'S BADGE PIN.—Orrin C. Dow and Alford C. Harvey, St. Johnsbury, Vt.
4,749.—CHAIN LINK.—Virgil Draper (assignor to Oscar M. Draper), Attleborough, Mass.
4,750.—STATUE.—Angelo Fusary, New York city.
4,751.—ORNAMENT FOR THE BACKS OF LOUNGES.—George Hartzell (assignor to John P. Reifsnieder), Philadelphia, Pa.
4,752.—CASTER BOTTLE.—John Hoare, New York city.
4,753.—ORNAMENTATION OF GLASS WARE.—William C. King (assignor to King, Son & Co.), Pittsburgh, Pa.
4,754 to 4,759.—JELLY GLASS.—William M. Kirchner, Pittsburgh, Pa. Six patents.
4,760 to 4,767.—CARPET PATTERN.—Levi G. Malkin, New York city, assignor to Hartford Carpet Company, Hartford, Conn. Eight patents.
4,768.—SODA FOUNTAIN.—George F. Meacham, Newton, assignor to James W. Tufts, Medford, Mass.
4,769.—ORNAMENTATION OF RUBBER SHOES.—Christopher Meyer, New York city.
4,770.—LAMP BRACKET.—Frederick R. Seidedsticker (assignor to Bradley & Hubbard), West Meriden, Conn.
4,771 to 4,772.—CARPET PATTERN.—John H. Smith, Enfield, assignor to Hartford Carpet Company, Hartford, Conn.

## TRADE-MARKS.

215.—WHISKY.—Mills, Johnson & Co., Cincinnati, Ohio.

## EXTENSIONS.

MACHINE FOR CUTTING AND BENDING SHEET METAL.—Elliot Savage, West Meriden, Conn.—Letters Patent No. 16,853, dated March 17, 1857.
MACHINERY FOR CLEARING AND SEPARATING COTTON, WOOL, FUR, AND OTHER FIBROUS MATERIAL.—Isaac Hayden, Lawrence, Mass.—Letters Patent No. 16,833, dated March 17, 1857.
HARVESTING MACHINE.—George Esterly, Whitewater, Wis.—Letters Patent No. 16,873, dated March 24, 1857.
FLUID METER.—James Cochrane, New York city.—Letters Patent No. 16,945, dated March 31, 1857.

## APPLICATIONS FOR EXTENSION OF PATENTS.

PLOW.—Blewford Bethel, Gerard, Ill., has petitioned for an extension o the above patent. Day of hearing, June 14, 1871.

IRON TRUSS FRAMES FOR BRIDGES.—Francis C. Lowthorp, Trenton, N. J., haspetitioned for an extension of the above patent. Day of hearing, June 14, 1871.

FACTITIOUS IVORY.—William M. Welling, New York city, has petitioned for an extension of the above patent. Day of hearing, July 19, 1871.

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LOCOMOTIVE ENGINEERING, AND THE MECHANISM OF RAILWAYS: A Treatise on the Principles and Construction of the Locomotive Engine and Railway Plant. With Examples Selected from the International Exhibition of 1862. Illustrated with sixty large engravings and numerous wood cuts. By Zerah Colburn, Esq., Civil Engineer. Part XVII. New York: John Wiley & Son, 15 Astor Place.


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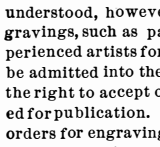

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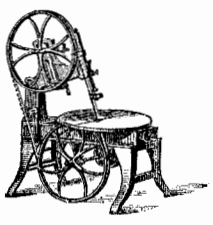
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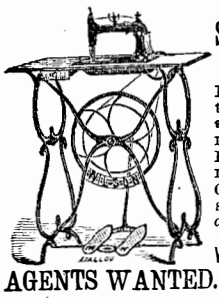
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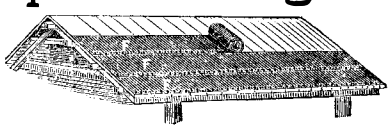

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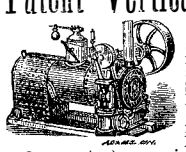

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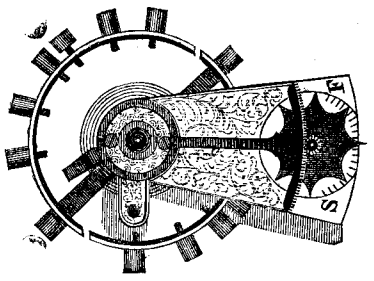

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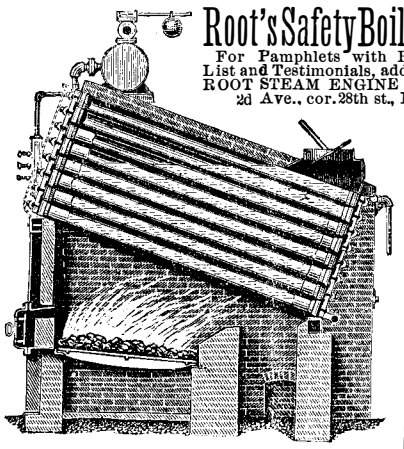

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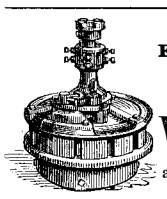

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